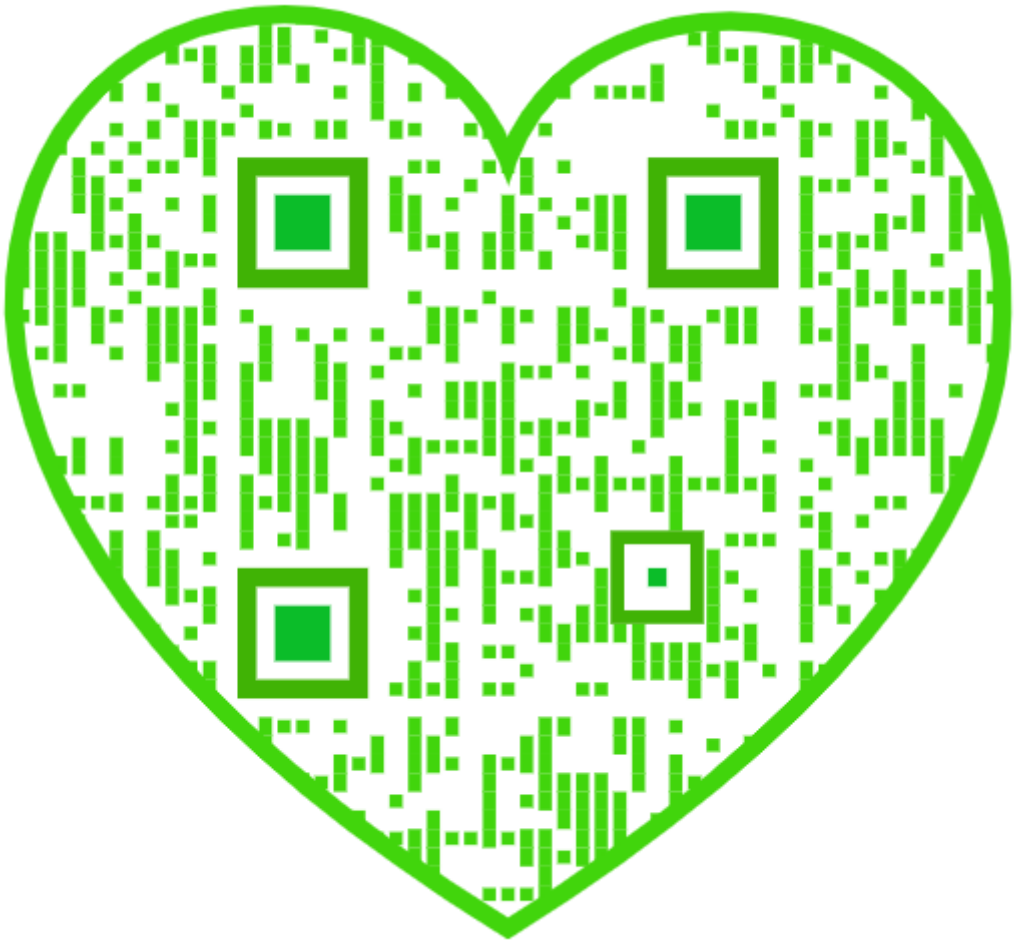

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A TEXT-BOOK OF

GYNECOLOGY

EDITED BY

CHARLES A. L. REED, A. M., M. D.

President of the American Medical Association (1900–1901); Gynecologist and Clinical Lecturer on Surgical Diseases of Women at the Cincinnati Hospital; Fellow of the American Association of Obstetricians and Gynecologists; Fellow of the British Gynecological Society; Corresponding Member of the National Academy of Medicine of Peru, etc.

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TO

R. C. STOCKTON REED, M. D., LL. D.

FORMER PROFESSOR OF MATERIA MEDICA AND THERAPEUTICS IN THE CINCINNATI COLLEGE OF MEDICINE AND SURGERY

THE LABOR OF THE EDITOR

IN THE PREPARATION OF THIS WORK

IS DEDICATED AS AN EXPRESSION OF FILIAL AFFECTION

PREFACE

In the preparation of this work there has been held in view the three following special objects, viz.:

1. The formulation of a *Text-Book* which shall serve as a *working manual for practitioners* and *students*, and which shall embrace the best approved developments of gynecology, including those of later date than are, or can be, included in a work of similar magnitude by a single author.

For this purpose assignment of topics was made to a considerable number of writers, but only to those who have acquired reputation in connection with the subjects upon which they were asked to write. This division of labour, giving to each writer a relatively small amount of work, insured a careful preparation of copy in the shortest possible time, and the issuance of a strictly up-to-date volume.

2. The co-operation of the various departments of medical science in their synthetic relation to gynecology.

For this purpose contributions were invited from several writers who are not gynecologists in the strict sense of the term. Thus the various topics upon pathology were given to pathologists, while those relating to bacteriology, dermatology, neurology, hygiene, etc., were assigned with similar appropriateness. As a consequence a single chapter, in some instances, is based upon contributions from several writers, while the whole has been rendered consecutive, systematic, and homogeneous by the Editor. The work is not, therefore, in any sense a mere aggregation of monographs.

3. The specific recognition of the work of investigators and operators in gynecology and correlated departments.

For this purpose invitations to contribute to the work were limited to those who had already contributed something to science. As a consequence writers were asked to treat their respective topics not only in a general way, but freely to express their individual views relative to the same.

The Editor has rendered into the third person all references by the different writers to their own work. In this way and by reference to the table of contents, the reader is enabled to determine the authorship of each particular paragraph.

The Editor feels a special sense of obligation to the contributors to the volume, whose clear and lucid comprehension of his objects and design and whose scholarly contributions have done much to lessen his task.

The work of illustration has been in the hands of Mr. R. J. Hopkins, whose previous special studies in anatomy as applied to art, and whose almost intuitive comprehension of the task, combined with excellent technical skill on his part, has enabled him to add materially to the value of the book.

Dr. Kenneth W. Millican, Assistant Editor of the *New York Medical Journal*, has kindly seen the pages through print, and it is to his vigilance, industry and scholarly supervision, that the Editor is indebted for the elimination of errors, which would have, otherwise, escaped detection.

To Miss Georgia A. H. Isaminger, secretary to the Editor, acknowledgments are due for efficient service in transcribing and arranging manuscript.

To the Publishers, the highest praise must be given for cordial co-operation at every stage of the work.

Charles A. L. Reed, *Editor.*

Cincinnati, Ohio.

CONTRIBUTORS

J. W. Ballantyne, M. D., F. R. C. P. E., F. R. R.
Lecturer on Midwifery and Gynecology, School of the Royal Colleges. Edinburgh, Scotland.

J. H. Carstens, M. D.
Professor of Obstetrics and Clinical Gynecology in the Detroit College of Medicine, Detroit, Mich.

Murdoch Cameron, A. M., M. D., F. R. C. S.
Regius Professor of Midwifery in the University of Glasgow. Glasgow, Scotland.

Henry C. Coe, M. D., M. R. C. S.
Professor of Gynecology in the University of Bellevue Medical College. New York, N. Y.

John G. Clark, M. A., M. D.
Professor of Gynecology in the University of Pennsylvania. Philadelphia, Pa.

F. X. Dercum, A. M., M. D.
Clinical Professor of Diseases of the Nervous System in Jefferson Medical College. Philadelphia, Pa.

Walter B. Dorsett, M. D.
Professor of Obstetrics and Clinical Gynecology in the Beaumont Medical College. St. Louis, Mo.

L. H. Dunning, M. D.
Professor of the Diseases of Women in the Medical College of Indiana. Indianapolis, Ind.

Frank P. Foster, M. D., LL. D.
Editor of the *New York Medical Journal*. New York, N. Y.

Samuel G. Gant, M. D.
Professor of Rectal Surgery in the New York Post-Graduate Medical School. New York, N. Y.

Hobart Amory Hare, M. A., M. D.
Professor of Therapeutics in Jefferson Medical College. Philadelphia, Pa.

Malcolm L. Harris, A. M., M. D.
Professor of Surgery in the Chicago Polyclinic. Chicago, Ill.

Maximilian Herzog, B. S., M. D.
Professor of Pathology in the Chicago Polyclinic. Chicago, Ill.

R. J. Hopkins, B. S.
Artist. New York, N. Y.

Joseph Tabor Johnson, A. M., M. D.
Professor of Gynecology and Abdominal Surgery in the University of Georgetown. Washington, D. C.

Wyatt G. Johnston, M. D., F. R. C. S.
Professor of Bacteriology and Pathology in McGill College and University. Montreal, Canada.

Matthew D. Mann, A. M., M. D.
Professor of Gynecology in the Medical Department of the University of Buffalo. Buffalo, N. Y.

Thomas Charles Martin, B. S., M. D.
Professor of Pathology and Rectal Diseases in the College of Physicians and Surgeons. Cleveland, Ohio.

Lewis S. McMurtry, M. D., LL. D.
Professor of Gynecology and Abdominal Surgery in the Hospital Medical College. Louisville, Ky.

Dan Millikin, M. D., LL. D.
Former Professor of Materia Medica and Therapeutics in the Miami Medical College of Cincinnati. Hamilton, Ohio.

Henry P. Newman, M. A., M. D.
Professor of Gynecology in the College of Physicians and Surgeons of Chicago. Chicago, Ill.

William Warren Potter, A. M., M. D.
Secretary of the American Association of Obstetricians and Gynecologists, and Editor of the *Buffalo Medical Journal*. Buffalo, N. Y.

A. Ravogli, M. D., LL. D.
Professor of Dermatology in the University of Cincinnati. Cincinnati, Ohio.

Charles A. L. Reed, A. M., M. D.
Gynecologist and Clinical Lecturer on Surgical Diseases of Women at the Cincinnati Hospital. Cincinnati, Ohio.

Hunter Robb, A. M., M. D.
Professor of Gynecology in the Medical Department of the Western Reserve University. Cleveland, Ohio.

James F. W. Ross, M. D., L. R. C. P., England.
Lecturer on Clinical Gynecology in the University of Toronto. Toronto, Canada.

A. W. Mayo Robson, F. R. C. S.
Professor of Surgery in the Yorkshire College of the Victoria University. Leeds, England.

J. L. Rothrock, A. M., M. D.
Instructor in Pathology in the University of Minnesota. St. Paul, Minn.

W. Japp Sinclair, M. A., M. D., F. R. C. S.
Professor of Obstetrics and Gynecology in Owen's College, Victoria University. Manchester, England.

Horace J. Whitacre, B. S., M. D.
Lecturer on Clinical Surgery and Demonstrator of Pathology in the University of Cincinnati. Cincinnati, Ohio.

E. Gustave Zinke, M. D.
Professor of Obstetrics and Clinical Midwifery in the University of Cincinnati. Cincinnati, Ohio.

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A TEXT-BOOK OF GYNECOLOGY

CHAPTER I

PROLEGOMENA

Gynecology—Historical *résumé*—Gynecology as a specialty—Nomenclature of gynecology—Radicalism and conservatism of gynecology.

Gynecology.—This word (derived from γυνή, a woman, and λόγος, understanding) implies, etymologically, the study or understanding of woman; but in its applied, modern sense, it means a consideration of the names, causes, prevention, symptoms, diagnosis, pathology, and treatment, of diseases peculiar to women.

Historical Résumé.—The evidence revealed by numerous papyri establishes beyond doubt that the ancient Egyptian physicians understood somewhat of the diseases of women, and that there were practitioners who devoted themselves especially to their treatment. The Mosaic writings reveal keen intelligence of the menstrual and reproductive functions; and the Talmud records the operation which subsequently became known as the Cesarean. The Greeks, deriving their knowledge from the Egyptians, improved upon their inheritance, and, with the writings of Hippocrates, marked the beginning of gynecology in the sense of a systematic treatise on the diseases of women. Inflammations, the disorders of menstruation, and uterine displacements, here occur for the first time in recorded science. The writers of the next five hundred years simply elaborated upon the teachings of the great master. The speculum vaginæ and the speculum ani were described by Galen, while vaginal examinations by the digital method were practised long before that epoch. In the third century B. C., Soranus wrote a book on the uterus and pudendum. Aëtius, Paul of Ægina, and other writers, show active and intelligent attention to divers diseases of women, including sterility. The speculum, duck-bill and multivalvular, was in use, as were the uterine sound and uterine dilators. These instruments, and a knowledge of their use, however, seem to have dropped into oblivion during the long night of the Middle Ages. It was not until 1761 that Astruc, of the medical faculty of Paris, reinvented the speculum which he describes in his writing, but which passed without attracting the general attention of the profession. In 1801 Réca-

mier introduced his really practicable instrument by that name, an event which marked the revival of the long-lost gynecologic art. From this date progress has been rapid. In 1809 Ephraim McDowell, of Kentucky, did the first ovariotomy, an event which marked the beginning of intrapelvic gynecologic surgery.

Uterine depletion by leeches (Guilbert); the use of the uterine sound (Lair); topical intrauterine and intravaginal treatment (Melier); the curette (Récamier); uterine pathology (Simpson); inflammation of the uterus (Bennet); anæsthesia (Wells-Simpson); the rediscovery of the univalve speculum (Sims); operation for vesico-vaginal fistulæ (Sims); oöphorectomy (Battey); pathology and operative treatment of the Fallopian tubes (Tait); infection of the upper genitalia (Noeggerath); perineorrhaphy (Emmet); antisepsis (Lister); and hemostasis (Koeberlé), are among the more striking events which have characterized the evolution of modern surgical gynecology. During this period it has been a constant beneficiary of the general development in the medical sciences. Many other names are entitled to be recorded upon a scroll more complete than is consistent with the limitations of this work. The aggregate result of such developments as are herein indicated comprises what is known as modern gynecology. It is obvious at a glance that the great steps that have been taken in the development of this department of medical science have been almost exclusively surgical; and with them, more conspicuously than any other names, must stand associated those of Marion Sims, Lister, and Lawson Tait. It must be admitted that the tendency to exclude rational therapy, in its broader and more general as well as in its local and special sense, from consideration in connection with the treatment of diseases peculiar to women, is an evil. The fact should be held in constant view, that gynecology is an integral and thoroughly correlated department of medical science. The gynecologist should, therefore, be grounded, not alone theoretically, but by years of actual practice, in all that pertains to the most advanced state of the healing art, considered in its broadest sense. He should, moreover, keep himself in constant touch with medical science in the various phases of its evolution.

Gynecology as a Specialty.—It is a fundamental law that progress is due to the gradual evolution of heterogeneity. This process is exemplified, not alone in the various phases of organic life, but in complex social organisms. The medical profession, considered as a constituent element of the social fabric, is subservient to the same law. Special aptitudes and special knowledge lead to correspondingly special occupations. This comes as a result, not alone of the tastes and predilections of the individual, but of the discrimination of those who become his patrons. It follows, therefore, that those who would assume to be specialists in any department of medical practice, but who are unqualified for the responsibilities which they invoke, sooner or later must fail. Specialism in medicine has an ethical basis which can not be ignored. These facts render the segregation of medical science

in its practical application inevitable. There is no practitioner but knows and does some things better than he knows and does others, and he is to that extent a specialist. If, however, he were to concentrate his attention exclusively upon those things which he knows best and to ignore those things of which he knows least, his intelligence would move only upon convergent lines. This is indeed the inherent mischievous tendency of specialism, and one which the gynecologist, as other specialists, should never cease to resist. The sphere of the gynecologist's labours has already resulted in a broadening of his activities. His constant experience with intraperitoneal conditions has resulted in his expansion into an abdominal surgeon, a fact recognised, not alone by the general consensus of the profession, but, specifically, by the creation in medical schools of professorships of "gynecology and abdominal surgery," or of "abdominal and pelvic surgery."

Nomenclature of Gynecology.—One of the chief embarrassments in the evolution of a science is an indetermined and essentially defective terminology. Words are but symbols, and each word, to properly fulfil its office, should be easily and definitely translatable in the mind into that for which it stands. In this way alone can language subserve, in the highest degree, its legitimate function as a medium for conveying ideas from one person to another. The language of medicine, says Dr. Frank P. Foster, is by no means free from the defective neologisms that are to be found in the contemporary literature of the other sciences. That they are more abundant in the writings of gynecologists than in other medical writings he is not prepared to admit. He considers that their formation is for the most part to be attributed to the rage for designating diseases, operations, and the like, by single words. Their defects generally consist (*a*) in joining a Latin word to a Greek word to make a compound; (*b*) in adding a Greek termination to a Latin word; (*c*) in reversing the proper order of the terms of a compound; or (*d*) in retaining an aspirate which any classical Greek writer would have suppressed. The following are examples of these forms of error: (*a*) "rectocolporrhaphy," made up of one Latin and two Greek words; (*b*) "annexitis," borrowed from the *annexite* of the French; (*c*) "hydronephrosis," instead of "nephydrosis"; (*d*) "anhydrous" for "anydrous." Most of these defectively formed words have, however, established themselves firmly in the favour of the multitude, and it would be foolish to seek to root them out at this late day; nevertheless, by pointing out their deficiencies one may hope to moderate, in some degree, the further coining of objectionable terms. Far more to be regretted than these errors of coinage, is the perverted meaning often attached to well-known words, as when we say "differentiate" for "distinguish," or speak of "single" and "double castration"; but even such perversions, however much they may offend the fastidious, throw no real obstacle in the student's way. The same can not be said, however, of the fancy that some authors have shown for dividing retroversion of the uterus, for example, into arbitrary "de-

grees." The need of the day, long since emphasized by Jonathan Hutchinson, is for the legitimate employment of well-understood words, preferably those that are short, easily remembered, and so far as possible in the vernacular.

Radicalism and Conservatism in Gynecology.—The essentially surgical character of modern development in gynecology has led to some abuses that are the necessary incidents of all surgical evolution. The operations of tenotomy in orthopædics, of tonsilotomy, and of the division of the recti muscles for the cure of strabismus, were followed immediately after their introduction, respectively, by indiscriminate application that resulted in damage to many patients. Other examples could be cited. In gynecology each new advance has been characterized by similar experiences. The use of the sound, of pessaries, and of caustics, was in each instance attended with early abuses. Emmet's operation for the repair of the lacerated cervix was followed by its needless performance in many cases. Oöphorectomy and the more comprehensive operations upon the uterine adnexa were followed, immediately after their introduction, by efforts to relieve by their means conditions to which, in the light of subsequent experience, they were not adapted. These abuses, if such they can be designated, are to be construed rather as evidences of conscientious efforts on the part of the profession to determine the remedial value of surgical expedients. Reactionary influences can be relied upon to correct these tendencies. The actuating motive in gynecology, as in other departments of medical and surgical practice, is to preserve in a safe or entire state, or to protect from unnecessary loss, waste, or injury, the various organs or structures that are the seat of disease. Any departure from this criterion must be attended with danger. From this point of view, conservatism in gynecology is to be commended. It should be remembered, however, that even reactionary tendencies may go to dangerous extremes. This is sometimes exemplified in an effort to conserve an organ at the expense of the general health of the patient. On this point it is well to be governed by the rule tersely enunciated by S. C. Gordon (*Philadelphia Medical Journal*, August 19, 1899) that "conservative gynecology demands saving health rather than diseased and useless organs."

All the splendid achievements of modern surgery, however, have been made in violation of the other equally legitimate definition of "conservatism"—namely: "Disposed to retain and maintain what is established, as institutions, customs, and the like; opposed to innovation and change; in an extreme and unfavourable sense opposed to progress." In view of the fact that the term conservatism of necessity carries with it the meaning expressed in the last as well as in the first definition, its introduction into the literature of gynecology is to be considered unfortunate. The life-saving impulse of the medical profession, and the yet unrelieved necessities of afflicted humanity, join in a demand for every innovation that will increase the efficiency of the healing art.

CHAPTER II

GENERAL ETIOLOGY OF DISEASES OF WOMEN

Prevalence—Causes: Civilization; education; personal habits; occupation; diseases; copulation; prevention of conception; criminal abortion; childbirth; the social evil.

THERE is a prevailing impression that the diseases peculiar to women are increasing relatively to the population. There exist no data upon which such an affirmation can be based. The impression probably depends for its existence upon the fact that such diseases are now better understood and more generally treated than formerly. Evidence is not wanting to indicate that the Anglo-Saxon woman is not degenerating. Bowditch has made some interesting observations on the physique of women, as follows: Of over 1,100, he found that the average height was 158.76 centimetres (5 feet 3½ inches). Sargent, in nearly 1,900 observations, the ages of the women ranging from sixteen to twenty-six, found the average slightly higher. Galton, in 770 measurements of English women from twenty-three to fifty-one years of age, also found a higher average—a difference due in part, no doubt, to the younger age of a number of the American subjects. In 1,105 subjects in ordinary indoor clothing Bowditch found the average weight to be 56.56 kilogrammes (125 pounds). These observations, compared with 276 by Galton, show that the average weight is a little greater among Americans. It would seem that while the tallest English women surpassed the tallest American women in height, the heaviest American women exceeded the heaviest English women in weight. Specific observation of this systematic character, however, is not necessary to impress the intelligent traveller with the generally satisfactory physique of the women of England and America. It is true that many defective specimens are found, and these come with relatively greater proportion under the observation of the physician. But no one can fail to be impressed with the fact that they comprise a distinct minority of the masses. The improvement in the physique of women has been very noticeable since the sentiment for athletics has supplanted that for the cloister, and since outdoor exercises have taken the place of those sedentary habits which, but a few decades ago, were considered the proper affectations of refinement. With that other and vastly larger class of people, who are not at liberty to choose their occupations, there has been a distinct improvement in physical estate. Improved habitations,

better hygiene, more humane regulation of occupation, more rational methods of education, and, with all, a more general diffusion of prosperity, are responsible for this improvement. It is a source of regret that this more or less optimistic view must be tempered by a frank recognition of yet existing evils which, to a certain extent, retard the progressive improvement of womankind, and are largely responsible for the diseases which, in the aggregate, comprise the subject of this volume.

Civilization.—The assumption has been made, and in some quarters entertained, that civilization, in the aggregate, exercises a deteriorating influence upon woman; that it develops her mind and brain and nervous system at the expense of other elements of her physical organism. There is no doubt that between the women of aboriginal peoples and those who belong to the civilized races there are certain physical differences, some of which tend to the production of sexual diseases in the latter. The reproductive function can be taken as an index. Savage women, as a rule, have but little difficulty in childbed, because they have large pelves and bear children with small heads. Accidents in childbirth, however, do occur among these primitive peoples with generally fatal results. Currier (*Medical News*, 1891), who has studied the physical and sexual condition of the North American Indians, says: "that pelvic disease has not been treated among Indians does not prove that it does not exist." The fact that Indian women are very generally the victims of venereal diseases establishes upon a firm basis the presumption that they must suffer from the remoter physical consequences of those diseases. Menstrual habits among many of the Indian tribes may well serve as an example to civilized women. The Mosaic rule that women during this period shall be put apart for seven days is observed in practice by these lowly people, who never heard of the records of Leviticus. Napheys, confirmed by Holder (*American Journal of Obstetrics*, 1892), says that "it is an inviolable rule among all these tribes for the women, when having their monthly sickness, to drop all work, absent themselves from their lodges, and remain in perfect rest as long as the discharge continues." Measurements made by Holder indicate that the average height of the Indian woman is 5 feet $3\frac{1}{2}$ inches; chest, $32\frac{1}{2}$ inches; waist, $29\frac{2}{3}\frac{1}{3}$ inches; hips, $34\frac{2}{3}\frac{6}{3}$ inches. The measurements of the perfect form of the civilized woman are given as follows: Height, 5 feet 5 inches; bust measure, 32 inches; waist, $26\frac{1}{2}$ inches; hips, 35 inches. It would not seem from this comparison that civilization is producing the disastrous results with which it is accredited. On the contrary, there are many evidences of an improvement in the physique of women of the civilized type, in which improvement the genital organs are no doubt participating.

Education.—Education of the conventional type has been held responsible for many of the ills peculiar to women. This criticism had much more point and force a few decades ago when the convent, with its seclusion and sedentary habits, determined the character of

women's education. The present, however, may be designated as the rational epoch in women's education—one in which they receive the maximum of physical, mental, and moral benefit with the minimum of injury. The most hopeful feature of the present *régime* is the tendency on the part of educators to study and regard the capacities and requirements of the individual pupil. Recognition is given to the primary biologic law of the antagonism between growth and genesis; and the effort is made in all advanced institutions of learning to adjust the curricula to the needs of the growing girl at different periods of her life. The doctrines of Froebel and Pestalozzi have relieved educational methods of much of their subjectivity, with the result that more attention is given to the education of the muscular system and the special senses; the book has largely yielded to the laboratory, and the cloister to the open volume of Nature. Potter (*New York Medical Journal*, 1891), recognising some of the yet remaining defects of the educational system, suggests that for girls between twelve and sixteen, study hours or school work be restricted to four hours daily; that during each catamenial period the recitation room should be avoided; that during this period girls should indulge in much mental and bodily repose; and that during the school period especially, which is also the period of most active growth, girls should be provided with an abundance of wholesome food and be instructed in the most careful dietetic habits, special stress being laid upon a full morning meal. The dress should be constructed with reference to relieving the waist line of all weight and pressure. He lays great stress upon the rule that no girl should enter a boarding school where the building is more than two stories high, and that stair climbing, at this developmental period of life, should be reduced to the minimum. Sir J. Crichton Browne urges that there are sexual brain differences between men and women which militate against the latter in higher education. While he admits that there are no trustworthy data for the estimation of the normal brain weight of healthy natives of Great Britain, he bases his conclusions upon the study of the brain of insane subjects, with the result that he finds the average excess of male over female brain weight to be 4.5 ounces, or, if allowance is made for the difference in bodily height, the excess of the male over the female brain weight is reduced to 1.05 ounces. Sir James Browne asserts that the posterior brain development is greater in woman, that the convolutions have a similar pattern, and that her left brain weighs relatively less than her right; but there is a marked difference in the distribution of the blood to the brain in the two sexes, and from these observations the conclusion is drawn that women are not fitted for the same educational tasks as are men. The whole argument is misleading, first, from the fact that the observations were made upon the brains of insane people; next, that they were not sufficiently numerous to justify a general conclusion; and, finally, that the results of higher education among women show that they improve physically as well as mentally, rather than deteriorate, under its influence. The last statement is confirmed

by Dr. Mary Dixon Jones, who, as a former principal of a young ladies' seminary, and latterly a successful practitioner with an extensive *clientèle* among women, asserts that menstrual disturbances are of rare occurrence, and that symptoms referable to the pelvis are but seldom complained of among young women students. The after life of such students indicates as good an average state of health and as high a degree of fecundity as among any other class. It is not apparent why intellectual occupation during the period of pubescence should interfere with sexual growth any more among girls than among boys.

Personal Habits.—That personal habits have much to do in the causation of pelvic diseases can not be denied. Habitual errors of diet resulting in constipation; general physical inactivity inducing sluggishness of the splanchnic circulation; and habits of dress seriously constricting the waist and imposing weight upon the pelvic viscera, are all to be taken into account. The corset, however, as an article of dress is not to be unqualifiedly condemned; on the contrary, if loosely applied, it serves as a protection rather than otherwise to the underlying viscera. More serious criticism should be directed to the deficiencies of dress of the neck, shoulders, arms, and legs. The influence of cold upon these more or less extensive areas can not but have a tendency to produce internal engorgements. Habits of outdoor exercise, now more or less prevalent, evince a hopeful tendency in the hygiene of women. Equestrian exercise, the bicycle, and golf, are all calculated to improve the physique of those who temperately participate in them. While this is true, it should not be forgotten that excessive activity in these, as in other wholesome sports, may be provocative of damage.

Occupation.—The modern extension of woman's activities has brought with it more or less of a penalty in the form of genital diseases induced by her occupations. It was not to be expected that women could adjust themselves without damage to labours which, through generations, had been arranged for men; nor could it have been expected that the several vocations could be at once so remodelled as to suit them to women's physical capacities. Clerking in stores, with its long hours of uninterrupted standing, employment in offices that were not provided with proper lavatory facilities, work in factories with imperfect ventilation, and the carrying of heavy burdens, are among the examples which illustrate the influence of occupation as a cause of pelvic disease in women. The peasant women of continental Europe work side by side with the men in nearly all occupations, and they are especially given to carrying heavy burdens upon the head, as is true of the American negro in the South. All these classes furnish examples of uterine displacements—especially procidentia and its attendant evils. The relative robustness of the European peasant women is largely a fiction. The modern household has many features that have etiological bearings upon this class of diseases. The thoughtless construction of houses, carrying with it the necessity of excessive stair climbing; the totally unnecessarily great weight of household utensils that must be

handled by women; and the performance of overhead tasks, many of them unnecessary, are causes to be taken into account. The sewing machine, while a great mercy to womankind in general, is, by its abuse, a fruitful source of mischief to those whom it was designed to benefit.

Diseases.—Aside from gonorrhœa and syphilis, mentioned in another paragraph, other diseases are provocative of genital disorders in women. Müller, of Munich (*Centralblatt für Gynäkologie*, 1890), has reported several cases in which miscarriages were induced by *la grippe*. The influence of the same disease upon the genital organs is noted by the same author, who finds that in a large number of cases it provokes either metrorrhagia, menorrhagia, or aggravation of sexual diseases already existing. Erysipelas may result in bacterial invasion and consequent suppuration within the pelvis and in puerperal fever. Neurasthenia, a distinctly constitutional state, may occasion symptoms which Goodell appropriately designated as nerve counterfeits of genital diseases. Engorgements of the liver, from whatever cause arising, may produce disturbance of the portal circulation to a degree that will induce passive congestion of the pelvic viscera. Constipation is a frequent cause of functional disturbance of the ovaries and uterus.

Copulation.—The sexual relation fulfils the meaning implied in the creation of two sexes. It is distinctly a physiologic function, yet errors in its establishment and practice frequently cause injury and disease in women. Coition, done abruptly for the first time, particularly if attempted by a male organ disproportionately large, may produce lacerations and dangerous hemorrhage. A penis of inordinate length may penetrate a woman so far as to exercise undue violence upon the uterus and adnexa, and thereby sooner or later induce disease of those organs. If practised too frequently, or in the absence of inclination on the part of the woman, or if repeatedly completed by the man before an orgasm is experienced by the woman, it sooner or later becomes a mere source of mechanical irritation to the latter. Prostitutes suffer greatly in consequence of the nonamatory character of their sexual relations, although in such cases the constant possibility of infection as a complicating causative factor must be held in mind. *Coitus reservatus* when indulged in by the female has a tendency to increase to an abnormal degree the turgescence of the organs. Van de Warker made a critical study of forty-two women of the once notorious Oneida community, which seemed to have been organized chiefly with reference to the practice of *coitus reservatus*, especially by the male, but under conditions of promiscuity. He found no greater prevalence of sexual disease there than elsewhere, nor was he able to find diseased conditions which he could attribute to the sexual habits of the community. *Sexual anæsthesia*, of frequent occurrence in women, is a cause of unhappiness and physical injury. *Sexual perversions* are to be considered in the light of both cause and consequence of genital disease. Masturbation is often caused by a pre-existing local irritation of the vagina or pudendum, or by adhesions of the clitoris to the prepuce, and it as frequently

causes similar disturbances. It is highly probable that there is no form of sexual perversion that is not associated with more or less congestion of the genital organs which remains after the act, whatever it may be, is completed.

Prevention of Conception.—Malthus formulated a doctrine which assumed to justify the limitation of families by the prevention of conception. Practices having this object in view have been known since Onan spilled his seed upon the ground. Many accessory practices, however, have come into vogue in modern times, none of which are destitute of serious consequences. The use of the vaginal douche immediately after intercourse, the use of a sponge within the vagina for absorbing the semen, the "womb caps," condoms, are all damaging expedients. If it is granted that their local physical effects are not deleterious, the fact still remains that their employment implies a psychic state inimical to the perfectly normal performance of the copulative act. *Coitus reservatus* is generally more damaging to the male than to the female.

Criminal Abortion.—There has been no time within the known history of the human race when women have not sought to avoid maternity. The induction of abortion as a means of limiting reproduction was known and practised by the Egyptians, the Greeks, and the Romans. Although certain social theorists have enunciated the principle of justifiable fœticide, it remains an unproved assumption that the practice is more prevalent to-day than in previous periods. That it is prevalent to-day, however, there is no denying; nor can the deleterious results of the practice upon the reproductive organs of women be ignored. Infections induced in this way, when not fatal, almost always destroy fecundity and render relief by surgical means imperative.

Childbirth.—Many of the injuries and diseases of women have their origin in childbirth. The relatively large cranial development of children borne by civilized women, rather than any other one circumstance, tends to increase the difficulties and dangers of parturition. Infection occurring in childbed, resulting in puerperal fever, or in infection of the endometrium or the Fallopian tubes, is yet of too common occurrence, although it is encountered with less frequency since the bacterial character of puerperal infections has become better understood. The recent great improvement in the obstetric art has already resulted in the practical disappearance of vesico-vaginal fistula and in the diminished frequency of both cervical and perineal lacerations. These conditions, however, are yet encountered as the demonstrable results of parturition.

The Social Evil.—The social evil has long been recognised as responsible for many of the physical infirmities of women. This evil, which has existed from the remotest antiquity and which will continue to exist as long as the race survives, is a necessary incident of social organization. It is properly recognised by all sociologists as an inevitable feature of social evolution. In dealing with it, therefore, it

is important at the outset to recognise it as an abiding fact rather than as an evanescent theory. In what way, therefore, does it exercise a deleterious physical influence upon society at large? The answer is that it works its mischief by the dissemination of the two great venereal diseases, syphilis and gonorrhœa.

Syphilis causes disease of the genital organs of women chiefly from the fact that it is communicated, for the most part, in the act of intercourse, and that the primary sore manifests itself in the genitalia. This, as a rule, is not an especially serious matter, although it may lead to the graver constitutional complications characteristic of the disease. In its hereditary form it is liable to manifest itself in defective developments and in temperamental deficiencies, both of which may be manifested in defective functional capacity of the genital organs. The manifestations of this disease in relation to the different organs will be considered in their appropriate places in this work.

Gonorrhœa, more than any other one disease, is responsible for those complications in women which are destructive of her reproductive capacity, which produce organic disintegrations, and which demand surgical interference for their relief or cure. Before Noeggerath demonstrated that the gonococcus (see *Micrococcus gonorrhœæ* under Sepsis) was the essential infectious element in the vast majority of intrapelvic suppurations, tubal and otherwise (see Pyosalpinx), gonorrhœa was looked upon as a local and comparatively trivial affection, involving the vagina and external genitalia. Since that time, however, the medical profession has come to recognise it as the most dangerous disease of frequent occurrence with which woman is afflicted, cancer, of course, being excepted. This assertion finds ample confirmation in the etiology and pathology of inflammatory diseases of women as presented in subsequent chapters.

The social evil being recognised as a fixed and inevitable fact, and the dissemination through it of venereal disease being so destructive to women, it is the manifest duty of society to subject prostitution to the most rigorous supervision. The medical profession owes it to itself, and to the humane objects to which it stands consecrated, to use its influence to secure the legal regulation of that evil which society has proved itself unable to suppress.

CHAPTER III

GENERAL PATHOLOGY OF THE FEMALE GENERATIVE ORGANS

Local pathology conforms to general pathologic laws—Peculiarities depending upon differentiated functions—Menstruation—Ovulation and gestation in their relation to pathologic states—The poise of the uterus and its variation—Bacterial origin of inflammatory diseases of the female genitalia—Tuberculosis—Syphilis—Trophic changes—Neoplasms.

Local Pathology conforms to General Pathologic Laws.—The general pathology of the female organs of generation in many respects does not differ from the general morbid anatomy and physiology of other parts of the body. Simple and specific inflammations, local bacterial infections, benign and malignant tumours, hypertrophy and atrophy, degenerations and other secondary changes, complications, and sequelæ, follow the same pathologic laws and types as are observed elsewhere in the organism. There may be minor differences, but these variations do not involve any fundamental change in principle. Of such slight deviations from the ordinary there may be mentioned unusual degrees of glandular hypertrophy, often developing after slight inflammatory irritation, such as we find, for instance, in the mucous membrane of the uterus. There are tumours, ordinarily very malignant in type, which in some parts of the female genitalia—the ovary, for example—may exist for a long time without involving neighbouring structures or giving rise to metastases. On the other hand, tumours histologically of a benign type may produce purely mechanical disturbances by their rapid growth, location, or otherwise, which may endanger or even take the life of the patient. There are, however, also quite a number of morbid phenomena and conditions to which the female only is subject, and which must be studied from a strictly specialistic standpoint, without, of course, losing sight of the great general principles of pathology.

Peculiarities depending upon Differentiated Functions.—The female genitalia in the human race perform such specific and well-differentiated physiologic functions that we should expect to find in them disturbances unknown elsewhere. Such is the case; for the functions of menstruation, ovulation, and pregnancy, are often disturbed in their exercise by underlying abnormal changes which call for particular attention.

Menstruation in its Relation to Pathologic States.—*Menstruation* brings about a cycle of profound though transitory changes in the

uterus. Congestion to a degree which anywhere else in the body would be abnormal, and actual hemorrhage, would, of course, be pathologic in any other organ but the female genitalia. It was formerly generally held that the uterus in menstruation shed its whole mucous membrane, this being regenerated from what little remained of the glandular epithelium. Herzog, who has carefully examined several menstruating uteri obtained by operation from living subjects and not post-mortem, agrees with Mandl, Westphalen, Gebhard, and others, who within the last few years have maintained that the uterus does not shed its mucous membrane in menstruation, but only loses some of the surface epithelium. It being conceded that this view is correct, there are then still present during and shortly after menstruation some small patches of mucous membrane denuded of surface epithelium. This condition certainly favours bacterial invasion whenever microbes are present, and a *locus minoris resistentiæ* is thus created periodically in the female which does not exist in the male. Morbid subjective symptoms, the disturbances of beginning menstruation, dysmenorrhœa, menorrhagia, amenorrhœa, and vicarious menstruation, are phases of pathologic phenomena necessarily peculiar to the female, and that are considered in detail in the section on Menstruation.

We thus find that the function of menstruation may and does carry with it to the female, dangers and pathologic conditions from which the male is exempt.

Ovulation in its Relation to Pathologic States.—We likewise find the same to be true with reference to *ovulation*. In it the physiologic processes and the accompanying tissue changes are of a type which may be well called quasi-pathologic. Paradoxical as it may appear, it may be well said that nowhere in the body do we have a physiologic process with such typical pathologic features as are found in ovulation. When a Graafian follicle has become mature and has approached the surface of the ovary there occurs at the time of ovulation a break in the continuity of the ovarian tissue, a *rupture*, accompanied by a *hemorrhage*, which may be more or less extensive. The gap so formed is in the normal course of events closed by the formation of cicatricial tissue, derived from connective-tissue elements. Herzog, who has studied the normal and pathologic anatomy of the corpus luteum, agrees with Clark (*Archiv für Anatomie und Physiologie*, 1898), who has recently reaffirmed the view that the lutein cells are not epithelial cells derived from the zona granulosa, but connective-tissue elements derived from the theca interna folliculi. The processes of rupture, hemorrhage, and cicatricial-tissue formation, are, with this single exception, entirely pathologic. (We will here neglect uterine menstrual hemorrhage, which is of a different character altogether.) In the ovary we find them as normal features of a purely physiologic process. It is obvious how easily these quasi-pathologic processes may overstep their physiologic limits and lead to truly morbid conditions, such as, for instance, marked cicatricial contractions with general premature atrophy of the ovary. Dan-

gers of ovulation to the female organism are also to be looked for in another direction. The normal living cells of the organism all possess more or less the power to resist bacterial invasion. In ovulation, however, we have, formed in the female organism right in the peritoneal cavity, a blood coagulum, a focus, not consisting of living cells, but of a dead culture medium, which at the body temperature is so notoriously favourable to the development of pathogenic micro-organisms. It has been said above that menstruation, in consequence of slight denudation of the uterine mucous membrane, creates here a *locus minoris resistentiæ* for bacterial invasion. This is true in a still higher degree with reference to the formation of the blood coagulum in an open cavity of the ovary. Herzog, in studying the histology and bacteriology of a number of cases of ovarian abscess, was struck by the observation that in the large majority of cases one is able to demonstrate that the abscess wall contains elements of the corpus luteum. In other words, these abscesses represent an infection of the corpus-luteum cavity with pus formation (empyema of the corpus-luteum cavity). The proliferative processes in the normal adult body, as a rule, do not lead to the formation of newly organized tissues. They only substitute tissue elements which in the cycle of metabolic changes have become senile, undergo dissolution, or are shed, as the case may be, and have to be replaced by younger elements.

In the ovary, during sexual activity, with the ripening of the Graafian follicle we have constantly a process of real new tissue formation which, as a rule, stops only during pregnancy, but which may even then persist (Herzog: Superfœtation in the Human Race. *Chicago Medical Recorder*, vol. xv, 1898). It is not improbable that the normal new tissue formation as found in the ovary in connection with the maturing follicle, stands in a certain relation as a predisposing, or even sometimes causative, factor in the development of neoplasms so frequently found in this organ. This view is here given in spite of the well-known fact that most neoplasms of the ovary are very likely of stromatogenous and not of ovulogenous origin. Among the neoplasms of the ovary, to be considered more in detail later, there is one of a most unique pathologic histogenesis—namely, the *dermoid cyst* or *embryoma ovarii*. Herzog strongly indorses the view so ably advocated by Wilms that these neoplasms are always of ovulogenous origin, not merely derivatives of ectodermal inclusions, and that they represent an attempt at pathogenesis.

Gestation in its Relation to Pathologic States.—The most important physiologic function of the female genital organs, *gestation*, leads to numerous pathologic conditions and complications. Most of these lie outside of the scope of this work, but a number of them properly fall within the domain of gynecology. Minor *congenital anomalies* of a type which in other parts of the organism throughout lifetime may be void of any practical moment, when found in connection with female genital organs may become of the greatest pathological impor-

tance. Some reference has already been made to this point when speaking of menstruation in the presence of a congenital obstacle to the catamenial flow. Of still greater practical bearing are those congenital anomalies which become responsible for ectopic pregnancy. The etiology of the most frequent form of gestation of this kind—namely, tubal pregnancy—is as yet a good deal contested and obscure. Herzog is of the opinion that in a large percentage, if not even in a majority, of cases, congenital anomalies are indeed the cause of ectopic gestation. Several cases have been reported in which there is left no doubt as to an etiology of this kind. (Henrotin and Herzog: Anomalies du Canal de Müller comme cause des grossesses ectopiques. *Revue de gynécologie et de chirurgie abdominale*, Paris, 1898.—Very Early Rupture in an Ectopic Gestation in a Tubal Diverticulum. *New York Medical Journal*, 1899.)

Pregnancy also furnishes the substratum of a peculiar kind of neoplasm found in the female, the *syncytioma malignum*. These tumours, developing during or shortly after pregnancy, are derived from fœtal structures—namely, the chorion epithelium, comprising the layer of Langhans and the syncytium. In some way or other these fœtal ectodermal structures acquire the properties of a malignant tumour, develop parasitic properties, invade the parental structure, primarily the sexual organs, and form distant metastases. In this manner embryonic tissues may become the starting point of a malignant tumour which ultimately destroys the life of the maternal organism. Here we have again an example of a pathologic event directly dependent upon a function of the female organs of generation, an occurrence which is of course impossible in the male.

The Poise of the Uterus and its Variations.—Among the peculiarities of the female sexual organs must be mentioned the delicate manner in which the uterus is balanced and held in position by the general arrangement of the parts in the female pelvis, in connection with a complicated ligamentary apparatus. It is very obvious why such a complicated arrangement should be necessary, when we consider the changes of position and size which the fruit bearer has to go through during the sexual life of the female. The delicacy of balance necessary from physiologic reasons becomes a fruitful source of morbid states. A very important and voluminous chapter in the pathology of the female sexual organs is that on the *malpositions of the uterus*. Of course, these malpositions are usually not of a primary nature; they are, as a rule, subsequent to other morbid changes. But these morbid changes *per se* are often very insignificant, and a long train of pathologic symptoms and conditions is only brought about in consequence of the changed position of the womb, its sequelæ, and complications. (See Uterine Displacements.)

Bacterial Origin of Inflammatory Diseases of the Female Genitalia.—If we now, from the standpoint of nosology, consider the general pathology of the female organs of generation, *inflammatory diseases*

first command our attention. After bacteriology had solved quite a number of questions with reference to general and local infections and inflammatory conditions in various parts of the organism, it was hoped, and firmly believed, that this youngest branch of pathology would also speedily contribute much toward showing us the true etiology of the great variety of inflammatory diseases of the female genitalia. The anatomic arrangement of the latter makes it *a priori* very probable that bacterial invasion plays a predominating rôle as a causative factor in all classes of inflammatory diseases. Döderlein, commenting upon this point with reference to such affections of the uterus, says: "Above any site in the body, the uterus seems to be the place favouring bacterial invasion and colonization. The open connection between the uterus, the vagina, and the outside world; the many chances for transport of germs which are so obvious, particularly during sexual life; stagnating secretions protected against desiccation and kept at a brood-oven temperature—all these factors unite to *a priori* impress us how well adapted the interior of the genitalia is for bacterial invasion and diseases dependent upon them." (See Sepsis.)

Yet it has been found that, in spite of all these apparently favourable factors, the internal genital organs of the healthy woman are not easily reached by pathogenic bacteria, and are, as a rule, sterile. The vulva, according to the unanimous verdict of all investigators, is frequently the seat of pathogenic bacteria, particularly the ubiquitous ordinary pyogenic micro-organisms. The vagina, however, in healthy women contains pathogenic bacteria only in a small number of the cases examined under the proper precautionary measures to avoid contamination. It, on the other hand, in healthy women always harbours a great many nonpathogenic bacteria. Yet, fully virulent pathogenic microbes, introduced experimentally, as has been done by Bumm, Menge, Krönig, Döderlein, and others, are speedily killed in the healthy vagina. Clinical and other experience has abundantly shown that the vagina under certain conditions loses its protective power of "self-purification." Particularly is this the case in parturition and immediately after delivery. A large percentage of septic inflammatory diseases of the female genitalia may be traced back to infection in parturition. Such septic infection may, of course, also be easily induced in the nonpuerperal state by unclean instruments passed into the uterus.

We know that malpositions or tumours of the uterus are responsible for hyperplastic inflammatory reactions of the endometrium. Deep lacerations of the cervix so frequently occurring in parturition, even without a manifest septic infection, may lead later on to chronic inflammatory changes of the uterine mucous membrane. In other cases of endometritis we miss every tangible anatomic cause, and for an attempt at explanation we must turn to such flimsy causative factors as nutritional and circulatory disturbances of unknown origin—trophoneurotic or vasomotor disturbances. It is, however, easy to understand

that in the tissues of the female organs of generation there may be established frequently, without the aid of bacteria, the initial stages of inflammatory processes arising directly out of a plus of the physiologic functions. Congestion and stasis, or, in other words, dilatation of vessels and diminution of the velocity of the current, which are among the first steps in the train of inflammatory changes, are normally found in ovulation, menstruation, and pregnancy.

The inflammatory diseases of the tubes and ovaries are often of very obscure origin, just like those of the uterus. This is particularly true of the ovary. In it we meet profound pathologic changes of this type, which baffle every attempt to get at their true cause as effectually as they resist all therapeutic measures. In such inflammations of the ovary we find cases with grave vessel changes, a pathologic process which has recently been described under the designation of *angeiodystrophia ovarii* (Bulius and Kretschmer).

Tuberculosis of the female genital organs, which may be a primary or a secondary process, is by no means so rare as was formerly believed. Some parts of the female genitalia are invaded frequently by the tubercle bacillus. Among these must be mentioned preferably the tube. It has been found that many cases of salpingitis, formerly believed to be simply septic in character, are really mixed infections in which the tubercle bacillus is present. Even the ovary, formerly held to be practically free from tuberculosis, is not at all immune but is occasionally infected. In the uterine mucous membrane we find tuberculosis in the acute miliary, the interstitial, and the ulcerative variety. Tuberculosis of the muscular coat seems to be rare, yet Herzog has seen a case in which the whole muscularis was literally studded with tubercles. (See Tuberculosis of the Various Organs.)

Syphilis of the Female Genitalia.—*Syphilitic* manifestations of a primary, secondary, or tertiary type, are frequently found in the pudendal organs, but very little is known about syphilis of the internal genital organs except the occasional localization of the primary sore on the portio or cervix. Herzog, who has studied the vascular changes of syphilis (A Contribution to the Histopathology of Syphilis: *Chicago Medical Recorder*, vol. xiv, 1899), is of the opinion that certain cases of chronic oöphoritis, in which no other causation can be obtained, and which present certain vessel changes very characteristic though not pathognomonic of syphilis, may be due to either the acquired or the congenital form of this affection.

Trophic Changes.—Reference has frequently been made to *hypertrophies* occurring in the female genitalia. Just as we find a peculiar liability to hypertrophy in these parts, so do we meet *atrophic processes*, some of which have so far baffled all endeavours to solve their etiology, as is, for instance, the case in the atrophic condition known as *kraurosis vulvæ*. (See Cutaneous Diseases of the Vulva.) Of course all normal physiologic senile changes must be excluded from the consideration of morbid atrophies, the most interesting of which are those of the uterus.

Normal, transitory lactative hyperinvolution may lead to permanent premature atrophy. This may also be brought about by a number of general infectious diseases, abnormal blood states (leucæmia), or metabolic affections (diabetes). Profound puerperal infection is the most common cause of partial or total atrophy of the uterus, and this may lead to grave local and general disturbances. (Bacon and Herzog: Fatal Perforation of a Uterus Partially Atrophied Post-partum. *American Journal of Obstetrics*, 1899.)

Neoplastic Changes.—The true intrinsic etiology of tumour formation in the female genital organs is as obscure to us in these parts as it is elsewhere in the organism. We know, of course, that the female genitalia are in an unusually high degree liable to become the seat of neoplasms. No part of these organs is free from tumour formation, and all types are met with. Three classes of new growth stand out most prominently. The horrible frequency of carcinoma of the uterus is a fact only too well known, not only to the profession, but even to the laity.

While diseases of the *mamma* have been left out of our consideration entirely, it perhaps deserves mention here that these accessory sexual organs of the female likewise belong to those organs which most frequently develop carcinoma. The second class of tumours which show a great predilection for the female genitalia is formed by the *fibromyomata*. Attempts have been made to explain their frequent development in the uterine muscularis upon the ground that the structure, from its physiologic changes in pregnancy, has an intrinsic tendency toward the new formation of muscle tissue. But this seeming explanation disregards the fact that while we have in pregnancy an enormous increase in the bulk of the muscularis, it is one, as is now conceded, which does not depend upon an increase in the number of the component muscle cells, but only upon an increase in their size. The third class of neoplasms occupying a very prominent place in the pathology of the female organs of generation, is the *cysto-adenomata* of the ovary. It has been previously mentioned what physiologic reasons may possibly stand in some causal nexus to the frequency of neoplastic formations in the ovary. In the cysto-adenomata of the ovary we have epithelial neoplasms which differ greatly in some respects from adenomata found elsewhere. The latter, as a rule, have a great tendency to become malignant and to change into true carcinomata. This tendency in the cysto-adenoma of the ovary is rare. (Henrotin and Herzog: Carcinoma Developing in Primarily Nonmalignant Cysto-adenoma of the Ovary. *Chicago Medical Recorder*, vol. xvii, 1899.) Here we have an extensive epithelial proliferation, which in other parts of the body is almost sure to lead to carcinoma, but which in the ovary does not seem to carry with it any great danger of developing malignancy. Not only are these cysto-adenomata very common, but they also often occur in women advanced in life, and they may exist for years and decades without ever changing their benign type. Pathologic pro-

cesses almost unknown in other parts of the body, but fairly often seen in the female in connection with benign epithelial neoplasms, are the *implantation metastases* of papillomatous adenomata of the ovary. These metastases are, as a rule, entirely void of true malignant features, and they generally disappear after the removal of the main tumour.

Another fact worth remembering in connection with the peculiarities of the pathology of the female genitalia, is the comparative frequency of neoplasms, particularly of a sarcomatous type, in the female infant and child.

In closing the foregoing considerations, it should be said that they do not pretend to furnish a full and exhaustive general description of all the pathologic phases and problems encountered in connection with the female genital organs. What has been attempted, is to give to the student of this department of medicine an idea of the special points of view and the particular physiological considerations from which the pathology of the genital system of the woman must be approached, which are considered in detail in various chapters of this book.

CHAPTER IV

GENERAL THERAPEUTICS OF GYNECOLOGY

General medication—Serum therapy—Local medication—Balneotherapy—Suggestion—Electricity—Massage.

General Medication.—The lines along which modern gynecology has developed have been so distinctly surgical that relatively less attention has been given to the question of therapeutics. The error involved in this tendency is shown by the fact that the female generative organs are in close vascular, nervous, and tissue, connection with the general system, of which they are as distinctly integral parts as are the eye, the ears, or other organs of special functions. They are capable of influencing and of being influenced by systemic states; and they are therefore, to a certain extent, amenable to therapeutic agencies. The medical aspect of gynecology is entitled to studious consideration. The deterioration of the blood, as manifested in the various anæmias, often finds expression in disturbance of the menstrual function; neurotic states not infrequently cause painful coition and dysmenorrhœa, while hepatic disturbances produce pelvic hyperæmias. It is apparent, therefore, that any therapy which will relieve the initial disturbance, will, to that degree, cure its results. This conception of the relation of the functional integrity of the genital organs to systemic states or to other anatomically remote diseases, must be the key to the intelligent employment of remedial agencies. Thus, a simple laxative may relieve ovarian tenderness, an active cholagogue may cure a congested uterus, and a course of iron and arsenic may become the most potent remedy for certain functional menstrual deficiencies.

That remedies given by the stomach exercise in any important degree an elective action upon the nonpregnant uterus or its adnexa, is open to doubt. Ergot and the bromides, for example, given as remedies for uterine hyperplasia, have disappointed expectation. Laxative agents, however, such as aloes and myrrh, which affect the lower alimentary canal, modify the functional activity of the generative organs by attracting an additional volume of circulation to the pelvis.

The most valuable general remedy in the treatment of the diseases of women, is *rest*. This should be looked upon just as if it were a material agency, duly catalogued, and described in the materia medica.

Rest in this sense implies not only physical repose, but, so far as possible, cessation from functional activity. To realize its full bene-

fit, the marital relations of the patient should be for the time discontinued, and the patient herself should go to bed. That kind of rest which patients are prone to take by donning a loose gown and lounging here and there about the house, engaging in one activity after another, amounts practically to no rest at all. The practitioner will do well always to explain in minutest detail just what he means by rest when he prescribes it. In many of the minor acute inflammations, noninfectious in character, this remedy is alone sufficient to cure.

Serum Therapy.—The treatment of gynecologic conditions by animal extracts was introduced by Jouin in 1895, and advocated in America by Polk (*Medical News*, January 11, 1899). The treatment of diseases of the uterus and adnexa by these agents is under advisement. Cures of amenorrhœa due to obesity are reported as resulting from their use. Polk has advocated the administration of thyroid extract for the cure of uterine fibroids, and has reported cases which seem to be improved by the remedy. The treatment seems to be based upon the well-known reciprocal trophic relationship existing between the uterus and the thyroid gland. This relationship has been emphasized by Freund (*Centralblatt für Gynäkologie*), who finds that swelling of the thyroid merely from congestion is always present in pregnancy, and also during menstruation. Wherever there is energetic or persistent irritation involving the uterine muscles, it will cause a persistent swelling of the thyroid. That this trophic impulse is derived from the uterus rather than from its adnexa, is shown by the fact that ovarian tumours and tubal dropsy do not cause enlargement of the thyroid, except when in rare instances they encroach upon and irritate the uterine muscle. These observations are in accord with those previously made by J. Fischer, who affirms and demonstrates not only the influence of the uterus upon the thyroid, but also that of the thyroid upon the uterus. Women with goitre generally suffer with menorrhagia and metrorrhagia; extirpation of the thyroid is followed by genital atrophy. Myxœdema in women is generally associated with amenorrhœa. In cretins, there is a diminution and often an entire loss of sexual power. Menstrual disturbances are among the earliest symptoms of exophthalmic goitre. These facts, long since established in America by Jenks, indicate beyond question the relationship existing between these two organs. It would seem that an extract made from the thyroid gland of the sheep and ingested into the human system exercises to some degree a modifying influence upon the uterus, its nutrition, and functions. The extent and exact character of this influence remain yet to be determined. Ovarian extract is given with the object of stimulating ovarian activity and of increasing the sexual appetite. Favourable reports of its use have been made, but whether the alleged results are due to physical or psychic influence remains to be determined. Protonuclein, locally applied, is unquestionably a valuable antistreptococcic agent, and reports are abundant indicating that it exercises a salutary influence over the nutrient activities.

Local Medication.—Local medication consists in the application of remedies directly to the part involved. This method of treatment is of great importance in many of the diseases which will hereafter be considered. The application of escharotics to an inital syphlitic sore and the topical use of an antiseptic solution in the treatment of vaginal gonorrhœa, are examples in point. Among the remedies thus employed for antiseptic purposes, the chief are mercuric bichloride, carbolic acid, lysol, creolin, and potassium permanganate. Among the local astringents may be mentioned the salts of lead, zinc, and even iron. Boric acid is a favourite with many practitioners, while tannin is the vegetable salt of greatest importance in this class of cases. The action of astringents, all of which are to a certain extent antiseptic and germicidal, is to influence the circulation of the capillaries upon the tissues to which they are applied. They are frequently of questionable value, and always of less value than those agencies which have a more powerful influence in destroying the micro-organisms upon which depend practically all of the inflammatory diseases in the mucous and cutaneous areas. Hydrastinine, a comparatively new alkaloid, derived from the *hydrastis canadensis*, has been found by Falk to be a valuable astringent, when used in ten-per-cent solution locally, for the treatment of uterine hemorrhage. Sedative lotions and emollient applications are frequently demanded to relieve local distress in the external genitalia.

Topical applications, having for their object the drainage of the pelvis by exosmosis, should be employed in practically all cases of acute inflammation, of chronic engorgement, or of persistent exudation within the pelvis. This treatment is made effective by virtue of the hygroscopic properties of glycerine. This agent has such powerful attraction for water that it abstracts it from any underlying tissue to the surface of which it is applied. This subject will be treated more in detail in connection with pelvic inflammations.

Balneotherapy.—In no department of medical practice has the use of water proved of more value than in the management of intrapelvic diseases of women. Emmet, many years ago, pointed out the value of the vaginal douche and demonstrated its *rationale*—the water at a temperature varying from 105° F. to 120° F. is applied with the patient lying on her back, and continued for a period of twenty minutes at each *séance*. As has been demonstrated by Emmet, the primary influence of the heat thus applied is to dilate the capillaries and to invite an increased supply of blood to the parts. In the course of ten minutes, however, the secondary effect of the heat is realized. This is characterized by blanching of the parts, a contraction of the capillaries, and a marked diminution in the volume of the local circulation. This treatment should be repeated at least twice daily. The results are invariably a marked amelioration of local engorgements, particularly when treatment is associated with rest and drainage by osmosis. Engelmann, of Kreuznach, has found general bathing

under scientific supervision to be a remedy of great value. Associated with friction, it acts on the same principle as a counterirritant, attracting a considerable volume of the circulation to the surface, thereby relieving splanchnic congestions, and, by stimulating the nervous system, becomes an active promoter of absorption. In this way it becomes valuable as a remedy for chronic exudates, adhesions, neoplasms, and in the treatment of amenorrhœa due to obesity. It is contraindicated in acute inflammatory conditions. Engelmann says that an efficacious bath ought to contain from four to six pounds of common salt or sea salt, and also from two to five pints of mother lye to four hundred pints of water. The temperature of the bath should not exceed 95° F., and its duration should not exceed half an hour. The influence of such a bath is to calm the pulse and respiration and to induce sleep, which should always be encouraged. The better time for taking such a bath, therefore, is just before bedtime.

Suggestion.—Suggestion as a therapeutic agent has been in vogue since the Pastaphori of Egypt practised it in the form of a "temple sleep," and ever since the healing by words was recorded in the Mosaic writings, or in the pages of the Zend-Avesta. It is based upon the influence of mental upon physical states, and while it has never received specific recognition as a distinct agency in gynecologic therapeutics, it is nevertheless a remedy of unconscious daily application by every tactful practitioner. That uterine and other genital disturbances exercise a perturbing influence upon the mind is a matter of constant observation: and that the mind diverted from the seat of discomfort, or thoroughly impressed with the thought of and confidence in the recovery, thereby stimulates the organism in the direction of health, is a fact long known and practised by the profession. Suggestion may be carried not only to the unconsciousness of pain due to local physical disturbances, but to the degree of anæsthesia in parts that are not the seat of disease. So powerful is this agency that operations may be, and have been, performed painlessly under the hypnosis thus induced. An agent of such power should be subjected to more critical study than has yet been accorded it by the profession. (See Anæsthesia.)

Electricity.—Electricity, in the form of faradism, is a remedy of some value when adminstered in such a way as to bring the nervous and muscular systems under its influence, when it acts as a promoter of metabolism and an important stimulant to the nutrient functions. Administered locally, under antiseptic precautions, with the negative pole in the uterus and the other upon the surface of the abdomen, it has been found to act as a stimulant in restoring the functional tone of that organ. With one pole in the vagina and another in the groin it has been found to relieve neuralgic conditions within the pelvis. Favourable reports have been made of its use in catarrhal endometritis. There is no doubt that, judiciously applied, it promotes the growth of the undeveloped uterus, for which purpose the intrauterine electrode should be the negative one and that placed over the abdomen or over

the sacrum should be the positive one. It has been found to promote the absorption of effused products in the pelvis, but it must be recognised as a dangerous remedy in this class of cases, for the reason that it is practically impossible in many of them to determine when the exudation does or does not depend upon purulent infection, in the presence of which electricity should not be used. Electricity in the form of a strong current causes chemical decomposition of the tissues by the process of electrolysis, by which the acid elements are attracted to the positive pole and the basic elements are attracted to the negative pole. It was the application of this principle that induced Apostoli, of Paris, in 1884, to attempt the disintegration and absorption of uterine fibroids by the use of strong electric currents. He began by using 100, which he finally increased to 250 milliampères, the strength of the current being accurately measured by a galvanometer. While, in many cases, this treatment temporarily arrested hemorrhage and diminished the size of the growth, its general results have not been accepted as satisfactory by the profession. It proved to be painful, causing, in many instances, deep eschars on the abdominal surface, intractable peritoneal adhesions, infections of the tumour, septicæmia, and, in some cases, death.

Massage.—Massage is one of the most primitive of remedies, and is utilized by many aboriginal peoples. Stanley found it in use among the hordes of Africa; Stevenson found it in use among the Navajos; it was a remedy among the ancient Chinese and the Hindoos; and it was employed by the Greeks and Romans. Hippocrates mentioned its use in diseases of the joints. In the great renaissance it appeared first in France, whence it spread to other European countries. Billroth, Esmarch, von Mosetig, Thiersch, von Bergmann, von Mosengil, and others recommended it highly, first in diseased conditions of the extremities, and finally as a therapeutic measure in diseases of the internal organs. In the form of *general massage* it is a valuable remedy for the promotion of metabolism and elimination, especially in cases of the neurotic type. In these cases, judiciously applied, it tranquillizes the nervous system, induces sleep, and, by virtue of its quality as a form of passive exercise, it promotes nutrition. It is of special value as an adjunct to the "rest cure." For the realization of its greatest benefits it must be given scientifically, for the details of which the reader is referred to the various manuals on the subject. Massage is contraindicated in all febrile states and in the presence of acute inflammation. Dr. George H. Taylor has devised a method called by him vibratory massage, which is utilized by means of specially devised apparatus. The method shows great ingenuity and a scientific conception of the subject, and deserves the most careful consideration. (See *New York Medical Journal*, April 2, 1892.)

Abdominal massage consists in the manipulation of the abdominal wall, and through it of the abdominal organs, for the purpose of promoting functional activity of the latter. As ordinarily employed, the

patient is placed in the recumbent posture with the abdominal walls flexed, when with the hand the abdomen is kneaded. This general exercise is supplemented by manipulations beginning in the right iliac fossæ and extending upward to the hepatic flexure of the colon, thence across to the splenic flexure, and thence downward to the sigmoid, the object being to stimulate the colon to activity. As a substitute for a manual manipulation of the abdomen, Sahli places a cannon ball on the relaxed abdominal wall and rolls it around in various directions, and Ivanhoff has suggested a substitute in the form of a hollow wooden or celluloid globe, partially filled with shot. A shot-bag has been similarly used with excellent results. When any one of these substitutes is used, its application should be concluded by rolling it repeatedly over the track of the colon from the cæcum to the sigmoid. Abdominal massage, to be most effective, should be given half an hour before breakfast and repeated half an hour after breakfast. By its employment the contents of the abdominal canal are moved onward, the portal circulation is accelerated, the lymphatics are given a fresh impetus, absorption and assimilation are promoted, the production of gas is diminished and its expulsion facilitated, and the splanchnic sympathetics are stimulated, while all the nutrient functions participate in the benefit.

Pelvic massage has been popularized chiefly through the influence of Thure Brandt. It consists in the manipulation of the pelvic organs by the bimanual method with the object of correcting displacements, of curing old adhesions, of effecting the resorption of old exudates, of stretching shortened ligaments, and of reducing hyperplasias. The patient to whom it is to be applied is given a preliminary treatment of mild laxatives to unload the rectum, and boroglyceride tampons in the vagina to lessen pelvic engorgements. The patient is placed in the dorsal position with her knees well flexed; the vagina is thoroughly cleansed; the operator inserts the index finger of his "handy" hand, thoroughly oiled, into the vagina, passing it well up behind the cervix; the other hand is placed over the suprapubic region. At this juncture, and before any special manipulations are undertaken, a careful bimanual examination of the pelvis should be made, a precaution which should be observed at the beginning of each *séance*. If points of recent engorgement or of especially acute sensitiveness are discovered the operator should desist. If, however, no such contraindications are found, it is prescribed, as the first movement of the massage, to press the external hand over and behind the fundus of the uterus, while slight downward traction is exerted by the tip of the intravaginal finger, the object being in all movements to draw the uterus gently toward the symphysis pubis. The ovaries are treated, when discoverable, by subjecting them to a similar range of mobility. Special movements are suggested by the particular conditions that may be discovered. A *séance* should not last over ten minutes, and the force to be employed, both in amount and direction, must be determined at the

time by the conditions encountered and by the judgment of the operator. After massage a boroglyceride tampon is inserted, and if the manipulations have been at all painful the patient should remain in a state of repose for several hours. The dangers inherent in this method of treatment are so many that it has been largely abandoned by those who formerly employed it, while, on theoretic grounds, it has been perhaps too unqualifiedly condemned by those who have never tried it. Its chief danger consists in the fact that the exact diagnosis of intrapelvic conditions is extremely difficult, and that consequently massage is liable to be employed with fatal results in conditions in which it is contraindicated. Among the accepted, but sometimes not recognisable, contraindications to the use of pelvic massage, are acute inflammatory processes; the presence of dilated Fallopian tubes; ovarian enlargements; cystic degeneration in either the ovaries or the parovarium; and, above all, the presence of pus in the pelvis. (See Diagnosis of Pyosalpinx.)

CHAPTER V

THE GYNECOLOGICAL ARMAMENTARIUM

The more modern principles of treating wounds have led to marked modifications in the surgeon's armamentarium, and in no part, perhaps, has the change been so pronounced as in the kind of instruments used in operative work. The day of instruments with elaborately carved wooden and ivory handles is past, and complicated trocars and tubular needles no longer have a place in our instrument cases. The present tendency is to simplify their construction as much as possible and to use no greater variety than is absolutely necessary. The choice of instruments must necessarily vary with the predilections and training of the individual operator. Certain main principles, however, should always be kept in mind. The surgeon need not encumber himself with such instruments as are seldom needed, or with a multitude of so-called "surgical conveniences" and "automatic appliances." He should, however, always provide himself with a liberal supply of the instruments in common use, in order to be prepared for emergencies. None should be retained which do not permit of easy sterilization. Knives should have smooth metal handles, and handle and blade should be in one piece. Instruments with grooves, depressions, and notches, are to be avoided. Good hemostatic forceps with smooth blades can now be obtained, and are just as effectual as the old ones with grooved faces. All scissors, forceps, needle holders, and the like, should have simple articulations, so that the different parts are readily separable. An instrument with permanent joints can not be kept surgically clean, and should therefore not be tolerated. With our present methods of sterilization, instruments made of steel do not suffer as they did formerly, and if properly cared for should not rust. Nickel plating has been proved to be not so valuable as was at first hoped, for, since instruments which are subjected to constant wear have soon to be replated, they would prove somewhat expensive. For those instruments which are but rarely used, however, nickel plating is advantageous, since it protects them from the action of the air.

Instruments made of aluminum have been recommended, but they are undesirable for the following reasons: (1) They are too expensive; (2) they are too soft; (3) they will not stand repeated sterilization.

In a hospital, one nurse or assistant should be given the full charge of the instruments, being held responsible for their proper sterilization and preservation. In private practice the surgeon must give the in-

struments his personal attention; and even in hospitals he will do well to watch closely the assistant to whom they are intrusted, in order to be sure that the constant careful attention which is absolutely necessary is being paid to them.

It is important to write out lists of instruments that are used in the different operations and to keep them where they can be easily consulted on each operation day, so that none which will be needed will be forgotten. Those lists should be divided into two parts, the first containing instruments which are sure to be required; the second, those that may possibly be needed under certain circumstances; they should therefore be prepared, although they may be set aside until they are called for. (For special lists of instruments, see the different operations.)

CHAPTER VI

DIAGNOSIS

Definition and scope—Indications and contraindications for vaginal examination—The gynecological examination: Physical; the armamentarium; the examination itself; inspection of the external genitals; digital examination; bimanual examination; rectal exploration; examination under anæsthesia; examination of the abdomen; regions of the abdomen; instrumental examination by (*a*) the speculum, (*b*) the sound, (*c*) the dilator, (*d*) the curette, (*e*) the aspirator—Examination of the secretions—Urine—Fæces—Menstrual discharge—The nervous system.

The diagnosis of a gynecologic case consists in determining the character and location not only of the local disease, but of any associated pathologic states. The destructive character of many of the infectious diseases and of both the benign and malignant neoplasms in women, and the essentially insidious onset of many of these conditions, render prompt examination and early diagnosis necessary for the welfare of the patient. This fact will be emphasized in discussing the diagnosis of individual diseases. To the end that diagnosis may be made early, it is the duty of the practitioner to impress upon his *clientèle* the importance of this step, and that it may be made accurately, it is essential that he should take the broadest possible survey of the patient and make the most critical investigation of even suggestive departures from health. It is better, in an effort to avoid a narrow investigation of simply the conditions complained of, to leave the examination of the genital state until all essential facts in the patient's general history have been ascertained. To this end systematic inquiry should first be made relative to the patient's age, hereditary influences, menstrual and marital histories, previous diseases, and present complaints. While these interrogatories are being made and answered the physician should cultivate the habit of carefully noting the patient's appearance, with special reference to her nutrition, her nerve poise, and her temperamental characteristics. The pulse should be counted, the tongue should be inspected; in short, a general survey of the patient should be made before strictly pelvic conditions are either inquired into or examined. All of the facts thus gleaned should be recorded and held in mind during the progress of the physical examination, which should embrace the following steps:

(*a*) The gynecological examination, including, if necessary, an exploration of the bladder and rectum and inspection and palpation of the abdomen.

(*b*) Special physical examination, including, according to the indications of the case, inspection of the throat and upper air-passages, percussion and auscultation of the heart and lungs, ophthalmoscopic examination, etc.

(*c*) Examination of the secretions—e. g., the urine, fæces, menstrual flow, and perspiration.

(*d*) Examination of the blood.

(*e*) Examination of the nervous system, with special reference to the determination of sensory and motor disturbances.

Indications and Contraindications for Vaginal Examination.—In cases of girls and unmarried women a vaginal examination, either digital or instrumental, should be undertaken only in the presence of positive indications. Youth and virginity should always be looked upon as contraindications for such an exploration, unless in the presence of more than counterbalancing reasons: such, for instance, as the presence of all the menstrual phenomena, the flow excepted, suggesting the possible retention of the menstrual fluid; or in the presence of an offensive discharge associated with remoter pelvic symptoms; or to investigate the origin of a persistent hemorrhage. There are numerous other conditions the importance of which will occur to the practitioner. It should be set down as a rule to which there are but few exceptions, that the examination of young girls in particular, and of many unmarried women of the nervous type, should be undertaken only under anæsthesia. In this way alone can they be protected from a serious moral shock and more or less physical discomfort. When the examination is being made great care should be taken to preserve as far as possible all virginal conditions; but this consideration ought not to obtain to the point of defeating thoroughness of exploration in the presence of manifest necessity.

In married women less hesitancy should be manifested in undertaking an examination, although even in such cases it should not be done for trivial reasons. When, however, there are either pudendal, vaginal, or high pelvic symptoms of an obscure character and sufficiently severe to justify treatment at all, the practitioner owes it both to himself and his patient to insist upon an examination. Any failure to take this stand is liable to be disastrous to both parties.

In women past the menopause, all symptoms of a pelvic character should be regarded with suspicion and inquired into with promptness and precision. This is especially true in the presence of hemorrhage at or about the period of the change of life—a symptom which is nearly always an evidence of malignant disease. (See Menopause.)

The Gynecological Examination.—It is as important in all gynecological procedures to establish accuracy of diagnosis as in any other department of medicine. The responsibility of the gynecologist is not second in this respect to that of his *confrères* in the other branches of medical or surgical science.

The foundation of correct diagnosis lies in the thoroughness of the

examination, and to this end every known means must be invoked in discovering the real seat of the malady and the character of its possible complications.

At the initial consultation a complete history of the patient's condition should be obtained and accurately recorded. For this purpose it will be convenient to have a book so bound as to contain one hundred histories, and so ruled and spaced that additional entries may be made at subsequent dates. It is a good plan to have the history blanks printed in sheets that may be filed temporarily and be bound after an adequate number have been filled.

The form of the blank can be devised by each physician according to his own preferences, hence it is only necessary here to call attention to the essential points of the record. These are—after entering the name, age, social condition, address, and other preliminary data—to record the family history as bearing on heredity; the menstrual history; the number of children borne and the character of the labours; miscarriages and their sequelæ; condition of bowels and bladder as to function; all pelvic phenomena that are abnormal; and, finally, every fact pertaining to the special condition for which the consultation is sought. After the physical examination has been made, all lesions, growths, or abnormities should be carefully entered, and the treatment advised or instituted, set forth in detail. Each physician, as he becomes impressed with the value that attaches to accuracy, will record all data shown by experience to be important. The foregoing are merely suggestive, and are, moreover, such as may not, in any case, be omitted.

Physical Examination.—After having made and recorded an oral examination of the patient, the next step involves a physical investigation by inspection, palpation, and pelvic exploration. The events under consideration in these pages are made applicable to office consultations, hence details are given adapted to that environment. Suitable rooms are requisite, and should number three or more, *en suite*—one a reception room, another a consulting room, and a third solely used for the examination. In this last there should be running water, hot and cold, and a toilet room adjoining is well-nigh a necessity. The examining and toilet rooms should be presided over by a comely woman, trained as an office assistant. She need not necessarily be a nurse, but she should be a trustworthy woman competent to hold a speculum and intelligent in all that pertains to gynecological work.

The armamentarium should consist of a table, specula, dressing forceps and tenacula, douche apparatus, absorbent cotton and antiseptic wool, sounds and applicators, lubricant, protective or pad, sheet, and gown.

The table should be strong and should stand solidly on its four legs. It should be capable of extension to enable the patient to lie in the horizontal position, reasons for which will be considered presently. It need not necessarily be an expensive or complicated affair, but should be equipped with foot rests, a thin mattress, and pillows.

An assortment of Sims's specula are essential, and one or two good bivalves will be convenient.

Every successful gynecologist knows the value of the Sims speculum, and every one who expects to practise the specialty must of necessity make himself familiar with its uses. The objection often made to it is that a competent person is required to hold it. If the beginner can not employ such a person, then he must provide himself with one of the so-called self-retaining Sims instruments. Potter prefers the Emmet self-retaining attachment for this purpose. It is the simplest and can be held easily by the patient, who will grasp a piece of rubber tubing passed through the fenestrum of the buttock blade.

Sounds and applicators are included in the office outfit, but it is proper to remark that they seldom will be needed. The indiscriminate use of the sound has proved harmful to many women, and should never be used by unskilful hands. Nevertheless it will occasionally be serviceable as an aid to diagnosis, hence is included in the list. Applicators, too, will rarely be employed. We need not enter into a discussion of the propriety of topical applications to the endometrium, but it will suffice to say that as a routine it is of doubtful propriety. Occasionally, however, such treatment is needful, hence the instruments must be at hand.

The selection of a proper lubricant is a matter of considerable importance. Vaseline is in common use, but it is not easily removed from the hands. Dudley (*Diseases of Women*, second edition, Lea Brothers & Co., 1900) prefers glycerine, which is cleanly, sterile, but expensive. Some are partial to glymol, certainly an excellent agent. Potter recommends alboline in collapsible tubes, which is thus kept germ free, is cheap, and efficient.

The so-called Kelly pad, really a device of Joseph Price, is a convenient protective, but it, too, is expensive, and besides is difficult to keep clean. A piece of rubber sheeting will answer every purpose, provided that it is rolled at the sides and back to prevent backflow of water.

A douche apparatus should be at command for all office examinations or treatment. It should consist of a reservoir that will hold at least a gallon of sterilized water, with rubber tubing attached to a vaginal douche nozzle with backflow arrangement, and the tubing should be equipped with a gate or cut-off. Before examination the woman should be divested of unnecessary clothing, such as corsets and superfluous skirts, then placed upon the table in the dorsal posture, with feet in the foot rests, and the pad or protective properly adjusted to prevent wetting or soiling the clothing. After covering her with a sheet, the douche may be administered. This should consist of an appropriate quantity of sterilized water at a temperature of about 115° F. If there is suspicion of infection, the douche should be rendered antiseptic by the addition of bichloride of mercury sufficient to make a solution of 1 to 2,000.

The Examination.—The preparation of the patient may be made by the office assistant, who, as we have said, should be a competent woman. She should arrange the clothing of the patient, administer the douche, and, if need be, give an enema to unload the rectum. This latter is important if there is constipation, as a distended lower bowel may mislead in diagnosis. Such a condition not only displaces the pelvic viscera, but it may be mistaken for a tumour, new growth, or retroverted uterus. After these preliminaries the patient is ready for the examination proper, which, it is almost needless to add, in these days of asepsis, should be conducted with the utmost aseptic care.

Fig. 1.—"The woman is now placed upon the table, usually in the dorsal position."—Potter.

The examiner himself should prepare his hands as carefully as if he were about to conduct an abdominal section or other important surgical operation. His lavatory should be supplied with the best of soap. A number of nail brushes, too, should be at hand, and of these there is none better, or indeed so good, as those made of vegetable fibre. They are cheap, durable, and can be kept clean.

We have already alluded to the administration of the douche, which should invariably precede the examination unless for some special reason it becomes necessary to inspect the uterine, vaginal, and vulvar fields, to study their secretions or exudates with a view to determine their character, in the expectation that they may furnish an important aid to diagnosis. But when it is used, particular care must be paid at the conclusion of the examination to the disinfection of the douche nozzle as well as of the hands of the physician and assistant and of all else that comes in contact with the patient.

Fig. 2.—". . . Or, according to the requirements of the case, or the preferences of the operator, she is placed in the left lateral prone, better known as Sims's posture."—Potter (page 34).

With these preliminaries the woman is now placed upon the table, usually in the dorsal position (Fig. 1), as already indicated; or, according to the requirements of the case or the preference of the operator,

she is placed in the left lateral prone, better known as Sims's, posture (Fig. 2), which is better appreciated if studied from the foot of the table (Fig. 3). Occasionally it will become necessary to employ the knee-chest posture (Fig. 4), and sometimes a woman should be examined while she is standing (Fig. 5).

Upon mounting the table, the woman should sit upon the end of it, which should be properly covered with protective and aseptic towels. A pillow should be provided for her head, but, as she is to lie flat upon her back, the shoulders should not be elevated by the pillow. A sheet or other proper covering should be spread upon her lap while she is yet sitting on the end of the table. She is now assisted to lie down, the nurse taking hold of her feet and placing her heels in the stirrups, which should be placed as close together as possible and which have been drawn out to receive them. The thighs thus become flexed, the abdominal muscles relaxed, and the knees widely separated. In a first examination it will often become necessary to assure the patient that she is neither to be hurt nor exposed, after which the covering may be parted and adjusted around the vulva, which is ready for inspection.

Fig. 3.—". . . Which is better appreciated if studied from the foot of the table."—Potter.

Inspection of the External Genitals.—It becomes necessary, especially with a strange patient, at a first examination to inspect the vulvar field with care. This is done, not only for diagnostic reasons, but for safety. A physician may become infected from a venereal sore, even on the person of an innocent woman, unless the presence of such a lesion is detected beforehand. To be forewarned is to be forearmed. In the investigation of such a case, abrasions of the hand, and especially of the examining finger, should be painted with collodion.

Fig. 4.—"Occasionally it will become necessary to employ the knee-chest posture."—Potter.

Having determined the nature of the secretions of the parts, and having carefully inspected the hymeneal orifice, noting whether the hymen has been ruptured, the examiner should next look carefully for the evidences of parturition—such as lacerations, cicatrices, and the

like—and then he may look for tumours, urethral caruncles, vulvitis, urethritis, eruptions, ulcerations, cystocele, rectocele, inflammations of Bartholin's and Skene's glands, œdema, and pruritus. The rectum should be explored with reference to hemorrhoids, fissure, fistula in ano, pinworms, and any anomaly of anatomic configuration. The clitoris should be examined with reference to any enlargement or an adherent prepuce. The vulvar orifice, if capacious or gaping, gives token at least of marital relations, whereas the virgin vulvar orifice is small, compact, with a more or less perfect hymen. The absence, however, of the hymen is not considered evidence of unchastity—a fact that should always be kept uppermost in the mind of the gynecologist, especially in the commencement of his practice. The condition of the labia minora should also be noted. When these are long, flabby, and pendulous in contour, it is probable that the woman is a masturbator. This condition of the minor labia, it is quite true, might arise from other causes, but this is the most probable explanation of it.

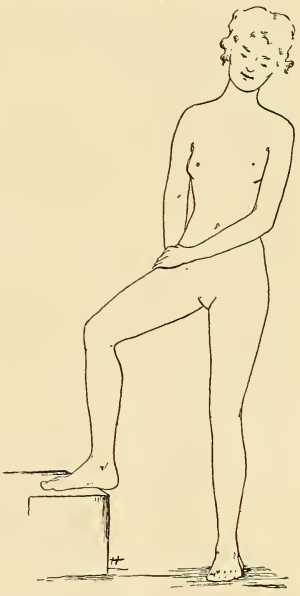

Fig. 5.—". . . Sometimes a woman should be examined while she is standing."—Potter (page 34).

While inspection is usually limited to the region and for the purposes named, it may be carried upward to include the surface of the abdomen, whereby enlargement or imperfection of contour may be discovered. Inspection of the interior of the vagina through the speculum, and of the rectum by a similar instrument, does not come within the limit of this section, but will be described under its appropriate head.

Digital Examination.—By far the most important method of investigation is the examination by the fingers and hands. The tactile sense is so acute, and may be so highly educated, as to supersede or take the place of every other method, provided one were limited to a single means of obtaining information. It becomes of the first importance, therefore, that it shall be employed intelligently, systematically, and thoroughly. We shall not enter into an argument as to whether the right or left index finger is the better for this investigation, but shall content ourselves with saying that while the specialist will frequently prefer the left, and most of such at least will be ambidextrous, the general practitioner will usually employ his right finger or fingers for the digital examination. An advantage in using the left finger is that it leaves the right hand free for instrumental use and for bimanual examination. Again, it preserves the right hand from the danger

of becoming an infection carrier, which is perhaps a matter of considerable moment in dispensary or hospital work. Sometimes it will be useful to employ two fingers in the investigation, but this will be rather the exception than the rule, limited to the capacious vagina and the short index finger. Two fingers in a narrow vagina are, to say the least, painful; but, as the index finger is sometimes short and the diagnostic reach can be increased perhaps half an inch by the conjoined use of the index and ring fingers, this expedient occasionally becomes not only justifiable but useful.

There is nothing that indicates greater gynecological skill than the tactful employment of the digital examination. The clumsy, hasty, and rough manner, in which it is sometimes used, is to be strongly condemned. On the other hand, it should be employed with the greatest delicacy, but at the same time with thoroughness, precision, and aptitude. Every gynecologist should avail himself of every opportunity to educate his finger tips; indeed, they should be brought to that degree of tactile perfection that a reasonable degree of accuracy in diagnosis can be obtained, in the majority of cases, without an appeal to instrumental aid. The digital examination becomes available and applicable in the horizontal, dorso-sacral, latero-prone, genu-pectoral, and standing, postures. But its chief application is in the dorsal or dorso-sacral postures. Finally, the index finger occasionally becomes of great usefulness in everting the anus by pressure through the vagina upon its posterior wall. In this manner the examiner will often detect with ease and precision rectal or anal faults that otherwise might remain obscure.

It remains for us to give the technique of the digital examination. To begin with, let us repeat, the toilet of the hands, and especially of the index finger to be employed, should be most carefully made. Thorough washing with soap and warm water and scrubbing with the nail brush should precede the lubrication. Then the finger tip, palmar surface downward, should be carefully passed into the vagina against its posterior wall, the fingers of the other hand being used to separate the labia and to slightly distend the vulvar orifice. In this manner it will note, first, the condition of the perineum, its rigidity or laxness, its integrity or imperfectness; secondly, the condition of the rectum, whether it contains fæces or is empty; thirdly, the relation of the coccyx to the pelvic outlet; and fourthly, the capaciousness or narrowness of the vagina. Turning now the finger upward and passing from side to side along the vagina, its lateral surfaces are explored, until finally the cervix uteri is reached. Here is an important field for investigation. If the cervix is soft, like the lips, a suspicion of pregnancy will arise; if firm or hard, like the nose, such suspicion will be dispelled. The cervix and os must now be carefully examined with reference to size and form and direction of the cervix, and the presence or absence of lacerations or new growths in the os. The importance of thoroughness with reference to this portion of the exami-

nation is to be insisted upon, and an educated finger tip is essential to its completeness.

Bimanual Examination.—A great advance in the diagnosis of pelvic diseases was signalized by the introduction of the bimanual method of investigation (Fig. 6). The term may be defined as the examination of the pelvic contents by the two hands, the index finger of one being in the vagina and the other placed on the abdomen above and beyond the pubes with which to make downward pressure. The finger within the vagina lifts up the organ or organs, and the finger tip of the other hand pressing downward upon the relaxed abdominal walls

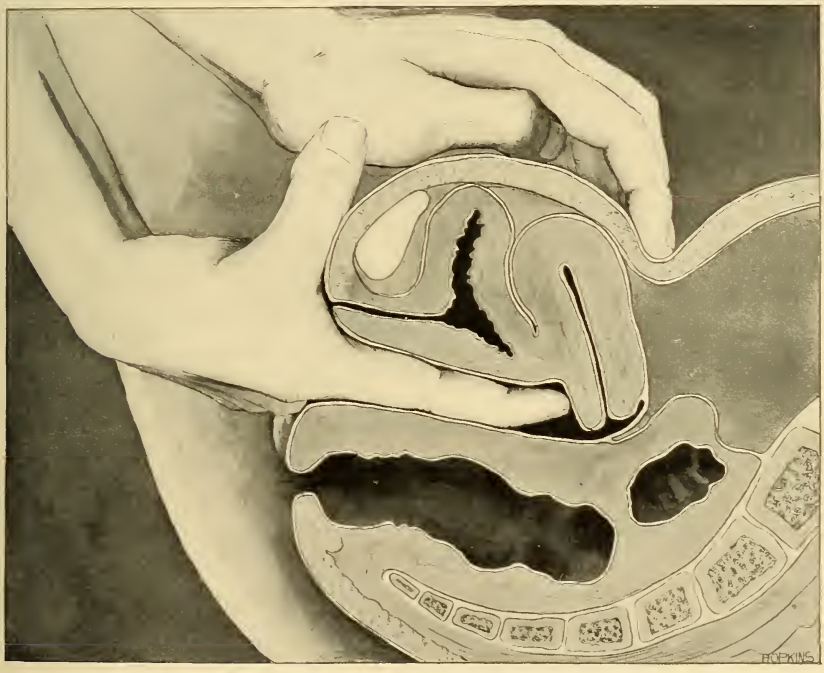

Fig. 6.—"A great advance in the diagnosis of pelvic disease was signalized by the introduction of the bimanual method of examination."—Potter.

engages it or them between the two. Beginning first with the bladder, its sensitiveness, distention, or emptiness, is noted. Passing upward to the uterus, its size, condition as to firmness or softness, and its position, whether in anteflexion, retroflexion, or prolapsus, is determined. Here, again, the first question upon the mind is that of possible pregnancy. If in the digital examination a soft cervix has been felt, the inquiry as to pregnancy must be pursued bimanually, and if it is learned that the uterus is enlarged and has floating contents the suspicion will be confirmed, and further examination should be postponed until the question is determined. It is important to deal with this sub-

ject first, because, in case pregnancy exists, it stands in the way of any further pelvic exploration lest abortion be induced. An exception to this rule would be when tumours or new growths coexisted with supposed pregnancy or complicated each other in an already diagnosticated condition. Then, if there is some technical point to determine, the bimanual examination may be cautiously further pursued.

Displacements of the uterus are most easily and certainly diagnosticated by means of the bimanual examination. The normal position of the uterus, it will be remembered, is one of moderate anteflexion, in which a line drawn through its long axis appears at the umbilicus; with the fundus, however, lying farther forward, compressing the bladder and impinging on the pubes, the uterine body will be easily engaged and mapped out between the two hands. It will, however, require some experience to distinguish between anteversion and anteflexion—all of which will be properly set forth by another writer under its appropriate head. Retrodisplacement of the uterus may also be determined by feeling the fundus resting against the rectum in the sacral excavation, and by its absence from its appointed place as ascertained by pressure of the external hand. The cervix, too, in retroversion, will be carried upward and forward toward the pubic arch, thus resting the entire organ horizontally across the pelvis at right angles to the normal direction of the vagina. Here, again, some nicety of touch, which a little experience may soon acquire, is required to determine between retroversion and retroflexion. Prolapse of the uterus is more easily determined, since the index finger will come in contact with the cervix just within the vulvar orifice, or a little higher up, according to its degree. Procidentia will readily be discovered upon inspection, since the organ in whole or in part protrudes from the vagina.

One of the most important functions of the bimanual is to ascertain the condition of the tubes and ovaries. An experienced examiner will readily discover whether the tubes are enlarged, pulpy, and soft or hardened, and whether the ovaries are unduly tender and sensitive, enlarged or atrophied, displaced, or the seat of new growths. An enlarged pulpy tube, sausagelike in shape, is suggestive of hydrosalpinx or pyosalpinx. At any rate, it means a diseased condition, which an accurate history combined with careful bimanual palpation will usually distinguish. The broad ligaments should also be carefully interrogated as to whether new growths lurk within their folds and if they properly support the uterus and adnexa. Adhesions, too, should be sought for, and if found, will of necessity influence further investigation and treatment. If the uterus and its appendages are tender, bound down by adhesions, or if there is an abscess or pus tube, great caution must be exercised in pursuing further investigation. It would be inexcusable to rupture such a pus-container, or to set up further inflammatory processes by the use of force in the bimanual, or through a resort to instrumentation.

It will be readily understood from the foregoing that the proper exercise of the bimanual in order to attain its greatest possibilities requires an experience that only long practice can give; hence, the beginner should never miss the opportunity of employing it under the supervision of a competent instructor. Only in this way can he learn either to bring the organs properly within reach, or to appreciate what he feels between his hands.

At the outset he will often be foiled in his efforts by the nervousness of the patient; this he must overcome by his tact and gentleness, always giving the impression that he is thoroughly at home in his work. If he betrays his inexperience by suddenness of movement, inexactitude of touch, or other evidences of the novitiate, his usefulness will be limited or destroyed. Complete muscular relaxation on the part of the patient must be obtained, and great self-possession by the examiner must exist. These two factors are conditions precedent to success.

It is well to remember in pursuing the bimanual method, especially when it becomes necessary to make upward pressure upon the vulvar orifice in order to reach high up in the pelvic cavity, that sometimes sensitive or passionate women may be incited to sexual orgasm from irritation of the clitoris; hence, contact with that organ should be avoided as far as possible. It is probable that the aggregate number of such patients is very inconsiderable, because illness, and especially disorders of the pelvic organs, diminish the tendency to sexual excitement arising from physical exploration of the genital tract. Its possibility, however, should not be forgotten.

To recapitulate, the information to be derived from the bimanual method of examination may be grouped as follows:

First, capacity, rigidity, and tonicity, of the vagina.

Secondly, as to pregnancy, *pro* or *con*.

Thirdly, the condition of the bladder and its relation to the other pelvic organs.

Fourthly, the uterus, its size, position, presence or absence of tumours within its walls, and the condition of the cervix as to integrity or lacerations.

Fifthly, the status of the tubes and ovaries as to size, location, and relationship to neighbouring parts.

Sixthly, the condition of the rectum as to fæcal impaction or disease of any kind, such as fistula, fissure, cancer, or hemorrhoids.

Seventhly, as to the presence of any abdominal or pelvic tumour, new growth, extra-uterine pregnancy, or any abnormal condition not embraced in the foregoing classification.

Finally, it may be remarked that in the case of tumours the bimanual affords opportunity to distinguish between cystic and solid growths, and, to a certain extent, between benign and malignant neoplasms.

Rectal Exploration.—It remains for us to describe examination by the rectum, which oftentimes becomes an important adjunct to the

examination. The index finger in the rectum will sometimes serve to clear up a doubt or detect a hitherto undiscovered condition. It will help to diagnosticate a retroverted womb or to distinguish between that displacement and a post-mural fibroid growth. Again, it will serve to locate a hitherto undiscovered ovary occupying Douglas's pouch. Still again, examination per rectum may detect disease in that organ which will explain symptoms that otherwise would have been misunderstood. In all cases in which careful vaginal bimanual fails to discover disorder adequate to explain symptoms or to suggest a diagnosis, rectal exploration should be made. This procedure is often disagreeable, if not painful, to the patient, hence, must be instituted with great delicacy and only after thorough lubrication of the examining finger as well as the anal orifice. External hemorrhoids, even if inactive, will further emphasize the importance of careful preliminaries to the exploration. (See Examination of the Rectum.)

Examination under Anæsthesia.—Finally, when all the ordinary means fail to overcome the nervousness of the patient, the rigidity of the abdominal muscles, or other hindrances to the thorough and intelligent employment of the bimanual method of examination, anæsthesia may be appealed to; indeed, with the full consent of the patient and with adequate assistance it should be resorted to as an important element in leading to correct diagnosis.

Examination by this means should be carefully conducted with reference both to its advantages and its dangers. Its advantages consist in overcoming hypersensibilities, both mental and physical, and in eliminating involuntary muscular resistance as a barrier to successful manipulation. By this means it is possible to explore with approximate accuracy the entire peritoneal surface of the uterus, both anterior and posterior. The ovaries and Fallopian tubes can be palpated; the presence and absence of intrapelvic tumours, including cysts, myomata, nodes, etc., can be determined. The presence or absence of adhesions can often be decided. The disadvantages of anæsthesia in gynecological examinations centre chiefly in the elimination of pain, which of itself possesses great diagnostic value, and is also a safeguard against injudicious and dangerous manipulation. It may be laid down as a rule, therefore, that anæsthesia for purposes of examination is dangerous in the presence of a degree of sensibility indicative of acute inflammation.

Auscultation, Percussion, and General Palpation of the Abdomen.—Of diagnostic measures, auscultation, percussion, and palpation, can be applied to the recognition and diagnosis of pelvic and abdominal tumours, inflammatory residues, and diseases of the appendicæcal region, kidneys, spleen, liver, and gastro-intestinal tract. The method of applying these aids to diagnosis will be readily suggested to the examiner. Palpation of the kidney becomes important in relation to the diagnosis of diseases of that organ, and occasionally, also, in distinguishing between abdominal tumours and movable and so-called

floating kidney. A movable kidney, which would escape the casual or indifferent observer, is often detected by a careful diagnostician. Hydronephrosis has been confounded with ovarian and other cysts. A detailed description of the diagnosis of kidney diseases is foreign to the purpose of this chapter, and the reader is referred to the section which deals with that subject. In examining the abdomen it is highly important, not only to hold in mind the locus of each of its contained organs, but to have an accurate conception of its regional arrangement.

Regions of the Abdomen.—It has been customary heretofore to divide the abdomen anteriorly into nine different regions as a convenient means of designating either the location of symptoms or operations, or of the presumably underlying organs and structures. This division, however, has proved unsatisfactory, because of the cumbersomeness of its terminology, the narrowness of the areas indicated, the indefiniteness of the imaginary lines of division, and the anatomical variations in the location of their supposed underlying organs and structures. In accordance with the suggestion of Professor Anderson to the Anatomical Society of Great Britain (*Buffalo Medical and Surgical Jour.*, 1893), these objections are best obviated by dividing the abdomen into four regions. This is done by running a line coincidently with the linea alba from the symphysis pubis to the ensiform cartilage, and another at right angles to this at the level of the umbilicus and encircling the entire body. The median line posteriorly is indicated by the spinal column. This arrangement, which is based upon definite landmarks, and divides the abdomen into four quadrants (Fig. 7)—namely, right and left, upper and lower—will be observed in the following pages.

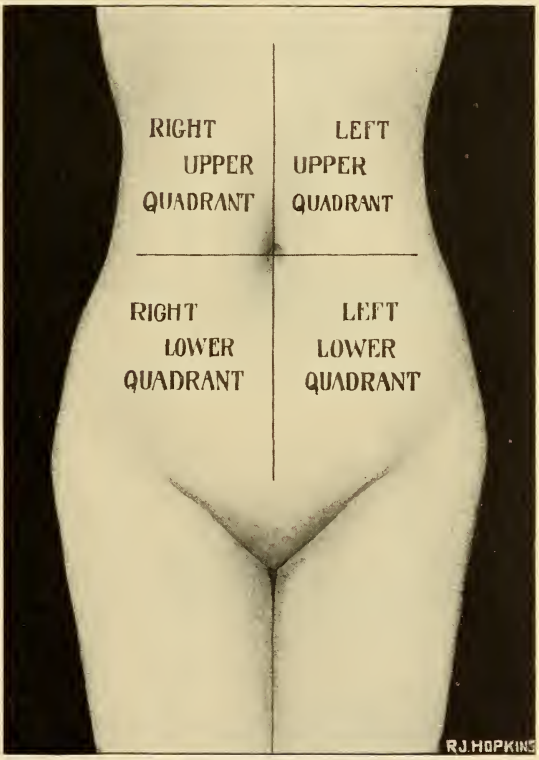

Fig. 7.—"This arrangement, based upon definite landmarks, divides the abdomen into four quadrants."—Reed.

Instrumental Examination.—A most important adjunct to methods of diagnosis is furnished in the marvellous development of mechanical instruments and appliances. The ingenuity of physicians and instrument makers has presented to the gynecologist an enormous collection from which to choose. The armamentarium, however, should be simple, and such instruments as are chosen should be models of perfection. It should never be forgotten, also, that instrumentation, no matter how dexterously applied, can never be made to supplant the educated hands and finger tips. Instruments at most are supplementary aids to these. We may, however, enumerate some of the instruments which are considered a necessity by the gynecologist. These are: (1) The speculum, (2) the sound or probe, (3) the dilator, (4) the curette, (5) the cystoscope, (6) the aspirator with exploratory needles, (7) the stethoscope, (8) the uterine dressing forceps, (9) the spatula or depressor, (10) the tenaculum, (11) the volsella.

Fig. 8.—". . . Speculum, which universally bears the name of Sims." —Potter.

The Speculum as a Means of Examination. — Since Sims gave to the profession the speculum which bears his name the practice of gynecology has become an established specialty. Without this device it is doubtful if gynecology could have been enlarged, broadened, and developed into the importance which it has attained at the present day. Dr. J. Marion Sims, then residing in the city of Montgomery, Ala., was engaged between the years 1845 and 1849 in the study of the operative treatment of vesico-vaginal fistula. During his investigations he accidentally discovered that if a woman was placed upon her knees and chest, upon separating the labia the air would enter the vagina and distend it to its full capacity. What was needed was an instrument to retract the perineum. This he supplied first with a spoon handle bent to the appropriate shape, and afterward, as the product of evolution, came the present speculum, which universally bears the name of Sims (Fig. 8). In the further pursuit of his investigations, and for the appropriate use of his speculum, a less trying posture was needed than the knee-chest. This led to further experimentation from which was evolved the semiprone, or Sims's, position. It is sometimes called the latero-prone posture, but, by whatever name it is known, its discovery and practical application are due to Marion Sims. The Sims speculum and the Sims position form the basis of the science of gynecology as at present understood and practised. Whoever, then, would attain suc-

cess in the art, must not only familiarize himself with the principles of this instrument and its correlative posture, but he must acqure deftness in their practical application to the patients who consult him.

The beginner, therefore, should address himself to the mastery of the use of the Sims speculum in the semiprone or Sims posture. The principles are simple and the obstacles to be overcome are few. It is a mistake to suppose that a long experience is necessary to attain proficiency in the use of the speculum. It is another mistake to presume that a trained assistant is necessary to its advantageous employment. The physician himself must be the expert; he can then easily instruct any intelligent person to hold the speculum properly. These examinations, for obvious reasons, should be conducted in the presence of a third person. A gynecologist of large practice has an office assistant who performs this service. A physician whose gynecological practice is limited may either avail himself of some member of his household in office examinations or employ the Sims-Emmet self-retaining speculum, which has already been referred to (page 32, *q. v.*). In making examinations at the home of the patient the aid of some member of her family may be invoked; and this brings us to make mention of home examinations.

In order to make these examinations satisfactorily and to obtain adequate information from them, the same conditions must prevail as in the consulting room. The patient must be placed upon a table, the douche must be administered, and the bimanual or instrumental examination is to be proceeded with, with the same attention to detail. Whenever the attempt is made to use the bed or couch dissatisfaction will result. It is, comparatively speaking, little trouble to make the home examination in the proper manner. The humblest home is furnished with a four-legged table; this can be covered with blanket, sheet, and protective; the fountain syringe can be hung on a nail near by, and if an instrumental examination is needful a Sims-Emmet self-retaining speculum can be employed. Or, failing in the possession of this, the ordinary Sims instrument can be used, and an assistant to hold it may be pressed into service from the household or neighbourhood.

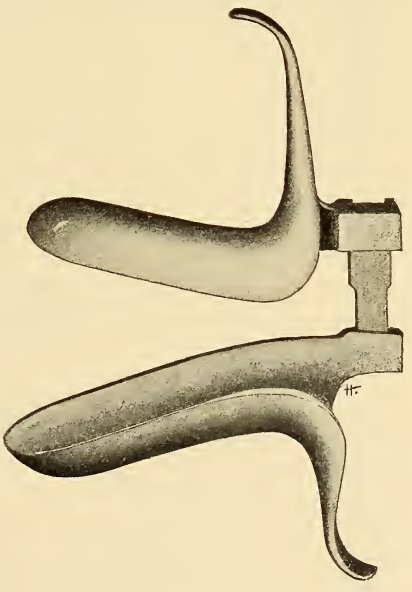

Fig. 9.—"A good bivalve like Gau's." —Potter (page 44).

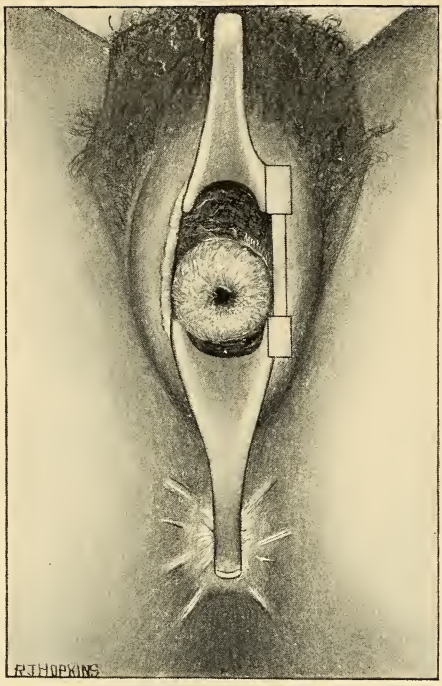

Fig. 10.—". . . Which gives a good view of the cervix."—Potter.

Before leaving the subject of the speculum it is proper to state that the essential requirements for the successful use of the Sims instrument are, first, the correct position of the patient; and, secondly, the proper holding of the instrument. The semiprone posture can not be described in words with sufficient clearness for a novice to understand it; moreover, it is difficult to illustrate it clearly, hence it is advised that a physician unfamiliar with it should place himself under the instructions of a person who understands it thoroughly.

Besides the Sims speculum, it is well to have at hand a good bivalve, like Miller's or Gau's (Fig. 9), which gives a good view of the cervix (Fig. 10), as well as a trivalve, the latter according to Nott's model (Fig. 11). It occasionally becomes necessary to examine the os or cervix uteri in the dorsal position, and these specula are well adapted to that purpose. (See Armamentarium.)

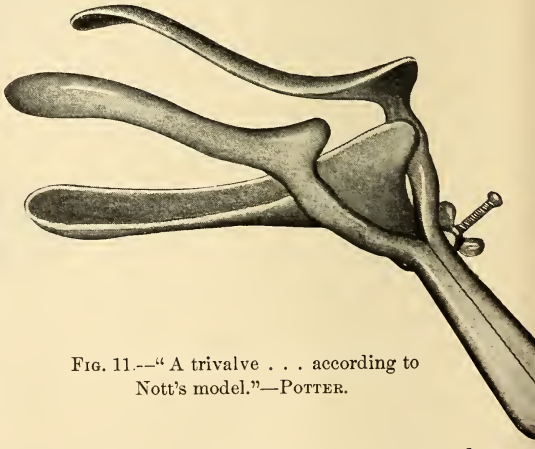

Fig. 11.—"A trivalve . . . according to Nott's model."—Potter.

In the use of the speculum it is sometimes desirable to use reflected light or the intense rays of an electric illuminator. In cases of erosion of various character, material assistance in diagnosis may be derived from the use of a magnifying glass, like that devised for the purpose by Dr. Alexander Duke, of Cheltenham (*Medical Press and Circular*, May 15, 1900). The lens, called a hysteroscope, is so arranged on a hinge that it can be placed at an angle by the observer. By this means the light can be di-

rected with accuracy upon the parts under examination, and when used with artificial light it acts both as a condenser and a magnifier (Fig. 12).

The Sound as a Means of Examination.—Formerly the sound was considered an essential part of the gynecological armamentarium, because almost the first thing done after the introduction of the speculum was to pass the sound into the uterus. Nowadays, however, with improved methods of diagnosis, and especially through a more thorough understanding of the bimanual, the sound rarely is needed. Its chief purpose is to confirm the diagnosis in doubtful cases, such as intrauterine growths and other intrapelvic abnormalities that are misleading in their character. The dangers of the sound consist in its liability to carry infection within the genital tract, and to puncture the uterine wall; the latter is, comparatively speaking, an inconsiderable danger, whereas the former is a very grave one. The sound devised by J. F. W. Ross (Fig. 13) is best designed to obviate all dangers. The sound is no longer used by the experienced gynecologist to reposit a displaced womb, and whenever it becomes necessary to use it as an aid to diagnosis, first, it should be made thoroughly aseptic, and then it should be dipped in pure carbolic acid rendered liquid by the addition of five per cent of glycerine, before it is passed into the uterus. With this precaution, and with gentleness in manipulation, the sound may not do harm, and possibly it may serve to clear up a doubtful diagnosis. The probe is only a modified sound, lighter in construction, and much more flexible, and practically is used for the same purpose. Applicators, either of whalebone or aluminum, are useful in carrying certain medicinal applications within the uterine canal. If, however, the uterus is sensitive from inflammation, the use of the sound, probe, or applicator, is contraindicated, although in some instances where information is urgently needed a very light probe might possibly be introduced without harm. The rule should be *never* to pass the sound or probe unless it can be used without causing pain.

Fig. 12. "The lens called a hysteroscope." —Potter.

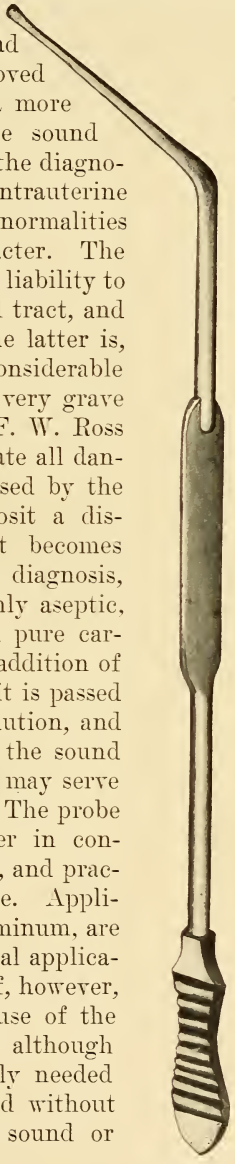

Fig. 13. "The sound devised by J. F. W. Ross." —Potter.

The Dilator as a Means of Examination.—Dilatation of the uterus is accomplished by graduated bougies, by metal dilators having divergent blades, by tents, or by

rubber bags to be filled with air or water. The usual method is through the medium of the hard-rubber graduated bougie or the mechanical steel dilator of Goodell (Fig. 14). The purpose of dilatation is to make the endometrium accessible to certain therapeutic measures, either medicinal or instrumental. In a narrow, or pin-hole, os it becomes necessary to dilate the channel before using the curette or making applications to the endometrium. Where but little dilatation is required, occasionally the glove stretcher or metallic dilator can be used without an anæsthetic; but usually when it becomes necessary to employ the more complicated instrument of Goodell, anæsthesia to the surgical degree should precede its use. When the os is patulous, curettage for diagnostic purposes may be made sometimes without resorting to anæsthesia. Diagnostitial dilatation often becomes necessary for the purpose of admitting the finger into the uterine cavity. It is an operation, however, that should never be made when there is a sensitive uterus to contend with, or when the pelvic tissues have been invaded with inflammatory conditions; in other words, it is necessary to surround this operation with all the precautions that pertain to formidable procedures. It is not to be done in the consulting room and the patient allowed to make her way homeward afterward, but it should be done either in hospital or at home, in order that the patient may be kept entirely quiet for the next few days thereafter. This operation is to be preceded with the seizure of the anterior lip of the cervix by the volsella, or strong tenaculum. The cervix is thus stretched and the dilator gradually and slowly passed into the cervical canal, the bougie with a rotary motion, the glove stretcher with a spreading of the blades in a gentle manner, just within the os, advancing a little farther and stretching again, and so on until the work is completed.

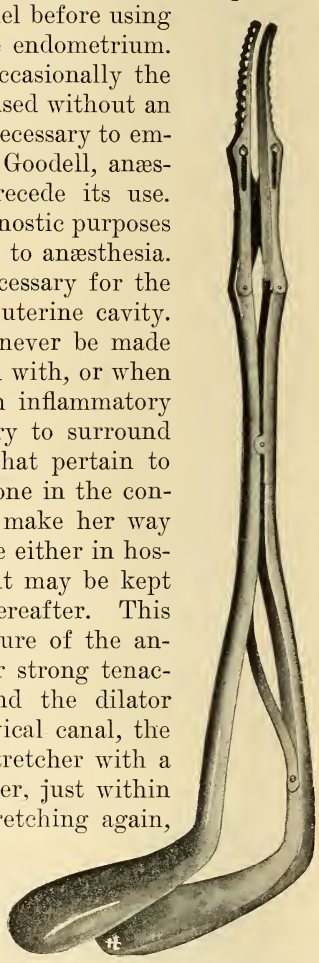

Fig. 14.—"The mechanical steel dilator of Goodell."—Potter.

The Curette as a Means of Examination.—This instrument is used to obtain scrapings from the endometrium with a view to determine the nature of any disease that may not otherwise be explained. These scrapings may be submitted to examination by the microscope. If malignancy is ascertained, the further method of procedure is readily pointed out. If there are remains of an abortion, or an endometritis that has followed abortion, then the interior of the uterus should be thoroughly cleaned, mopped with pure carbolic acid or carbolic acid and iodine, and the organ should be packed with antiseptic gauze. The curette is often used unnecessarily, and great caution should be observed

in its employment. The puerperal womb is easily perforated, an accident that has often happened in unskilful hands.

The Cystoscope as a Means of Diagnosis.—(See Examination of the Bladder.)

The Aspirator as a Means of Examination.—This instrument is sometimes appealed to when cysts or pus pockets develop along the broad ligament. In doubtful cases these sacs may be explored through the roof of the vagina, but it is generally sufficient to diagnosticate them by the usual means, and to evacuate them by surgery through the abdomen or vagina.

The stethoscope is occasionally employed to ascertain the nature of abdominal diseases, especially when pregnancy is suspected. The uterine dressing forceps and the depressor are an essential accompaniment to the armamentarium and need no particular description. The forceps carries cotton in wiping the tract, and the depressor holds the bladder away from the field during inspection. The tenaculum and volsella are used to seize the lips of the uterus in order to draw down the organ or to steady it while the parts are being inspected and applications are being made. These instruments should be dipped in pure carbolic acid before using.

Examination of the Urinary Tract.—(See Examination of the Secretions and Diseases of the Urinary Tract.) With this, should be associated a systematic investigation of the various parts of the body. It is well enough for convenience' sake to begin with the upper air-passages; nose, throat, and fauces, should be investigated, particularly in cases in which there exist head or nerve symptoms, so frequently referred to as genital reflexes. A similar investigation under similar circumstances should be made of the eyes and ears. Careful auscultation and percussion of the heart and lungs should be made when there are irregularities of the former, or when the latter may be subjected to suspicion by pelvic or other symptoms suggestive of tuberculosis. It is not presumed that every practitioner is capable of making a thorough examination of each of these several organs; but any one who assumes to practise gynecology should be so thoroughly grounded in a general knowledge of medical science that he can, with reasonable accuracy, determine departures from health in all bodily structures or functions. If it is necessary to carry an examination of any of these organs to the point of technical perfection, they can be, and should be, relegated to special practitioners for that purpose.

Intrapelvic disease is a fruitful cause of perversions of practically all of the secretions. These functional disturbances, in turn, become factors in the case and need to be dealt with as such.

The Urines.—In consequence of the great advance which has been made in the study of pathologic conditions of the genito-urinary tract, and in view of the fact that the urine secreted by either kidney differs from that secreted by the other, it is now important to speak, not of

the urine, but of the urines, when reference is made to the secretions which accumulate in the bladder. The technique involved in securing the urine from either kidney is considered in the chapter devoted to that subject. The investigation of the blended urines, however, is still a matter of clinical importance. Care should be taken to determine their quantity, colour, and specific gravity, the presence or absence of albumin, glucose, mucus, tube casts, pus, or other morbid products. In view of the importance of xanthine and the paraxanthines in the causation of various nervous phenomena, an examination of the urine will frequently need to embrace a qualitative and quantitative determination of these substances. Urea and uric acid are of clinical importance and need to be studied. In many cases it will be important, not only to study the urine from each kidney, but also to study each urine and the blended urines repeatedly. To insure completeness of examination it is important to follow the usual blanks available for the purpose.

Fæces.—In many gynecologic cases, particularly in those associated with marked disturbances of nutrition, it is of great importance to investigate carefully the fæces. Their naked-eye characteristics should be noted, and microscopic studies should be made of various kinds of their constituents. Blood, fats, parasites, fungi, foreign bodies, mucin, ferments, hydatids, etc, are only mentioned to suggest the range of inquiry which should be made in many of these cases. The reader is referred to Jaksch's Clinical Diagnosis.

The Menstrual Discharge.—It is often important to determine with accuracy the quality and quantity of the menstrual discharge. To determine its character the napkins should be preserved and inspected. It should be remembered, however, that the absorption of the blood by the napkin modifies to an important degree the colour of the former. If more critical examination needs to be made, some of the discharge can be mounted upon a slide and put under the microscope. If there is occasion to ascertain the quantity passed, the napkins should be carefully weighed before and after being used. In some cases it is important to determine whether the discharge is a true menstrual flow or a lochial discharge. For this purpose the microscopic examination is essential. It may be mentioned in this connection that in the menstrual flow immediately after its onset, there occur abundant red blood-corpuscles and prismatic epithelial cells laden with fat. These are derived from the interior of the uterus. As soon as the physiologic climax of the flow has been reached, the red blood-cells diminish and the leucocytes progressively increase until the flow disappears. The fluid which passes following a parturition, is, in the absence of hemorrhage, thinner in consistence, with less tendency to coagulate. While it abounds in red and white corpuscles from the start, it shows, also, abundant epithelium from both the uterus and vagina. Unlike menstrual fluid, the lochia, even in the absence of septicæmia, abound in microbes.

The Blood.—Every practitioner should provide himself with the necessary instruments for the examination of the blood. These should include an apparatus for counting the blood-corpuscles, chromo-cytometer, and a hemometer. With these instruments and a good microscope, with which all modern practitioners are presumed to be provided, it will be possible to determine the blood state of patients. This is an exceedingly important diagnostitial measure in gynecological practice. Thus a marked leucocytosis, taken in connection with other symptoms, is confirmatory of a suppuration which may be situated so remotely in the pelvis as to defy detection. Oligochromæmia, in varying degrees, may be accepted as an index of general states of nutrition; the perturbation of which may depend, in the first instance, upon obscure and otherwise undetectable conditions within the pelvis. Reed has shown (*American Journal of Obstetrics and Gynecology*) that many perverted conditions of the blood are caused in the first instance by disease of the pelvic organs, the disturbing influence of which is exercised, through the intimate nerve connections, upon the hematogenetic function. When these changes and their causation are better understood, the diagnostic value of blood states, considered as indicative of intrapelvic disturbances, will be greatly enhanced.

The Nervous System.—The intimate relation of the entire genital apparatus with the nervous system (see Nervous Complications in Gynecology) renders it important that the gynecologist should make a careful note of the actual state of the nerve functions. He should learn to appreciate nerve disturbances as much from the neurologic as from the gynecologic standpoint. Motor and sensory disturbances should be determined by instruments of precision, while the special senses should be investigated with accuracy. Psychic states should be studied with care. Careful attention to these precautions will speedily result in reducing the now chaotic subject of "genital reflexes" to a somewhat scientific basis.

CHAPTER VII

SEPSIS

Sepsis defined—The bacteria of sepsis—Local sepsis: Symptoms, pathology, and treatment—General sepsis: Symptoms, pathology, and treatment.

Sepsis—derived from the Greek word σῆψις (from σήπεσθαι, to rot); French, *sepsie*; German, *Fäulnis*—is defined by Foster as putrefaction, rotting; in medicine, the morbid condition resulting from the absorption of putrid or putrescent material or of germs capable of causing putrefaction. As used in this connection it implies a condition of either (*a*) local, or (*b*) general, infection by pathogenic micro-organisms. The relation of bacteria to fermentation and putrefaction was first demonstrated by Pasteur, from which phenomena he deduced the theory that suppuration in wounds was probably due to external agencies, and, by subsequent experiments, demonstrated the correctness of his analogy. The theory thus established found its first practical application at the hands of Lister, who, by a succession of careful and painstaking experiments and clinical observation, laid the foundation for the technique of antisepsis. The entire practice is based upon the now demonstrated and accepted fact that micro-organisms are the essential factors in the causation of both local and general sepsis. These micro-organisms embrace both micrococci and bacilli, a comprehension of the identity and pathogenesis of each of which is essential to an understanding of sepsis, its prevention, and treatment.

The Bacteria of Sepsis

Micrococci.—Of the micrococci both the staphylococci and the streptococci play important parts, often coincidently, in producing sepsis.

(A) *Staphylococci*, although occurring in several varieties, have a more or less common morphology in the particulars that they are (*a*) small, spherical cells; (*b*) that they vary from 0.7 μ to 0.9 μ in diameter; that they occur singly, in pairs (diplococci), frequently in fours (tetrads), or in masses (zoöglœa). The varieties about to be considered differ from each other chiefly in colour, the character of the pigment they throw off, their behaviour in different media, their degrees of virulence, and finally in the particular of their natural habitat. While there are other varieties of staphylococci, but four will be considered in this connection—viz.: (1) The *Staphylococcus pyogenes aureus* is the most common pathogenic micrococcus (Fig. 15). Having the

morphologic feature already mentioned, it is only important to add that it multiplies rapidly at normal temperatures in nutrient media. While growing in gelatine, which these cocci liquefy, they accumulate near the surface, producing, when brought in contact with the air, a characteristic golden-yellow pigment which is precipitated to the bottom of the tube and from which they take their name. Sternberg gives the thermal death point in moist media at from 56° to 58° C. (132.8° to 136.4° F.), but when dried at from 90° to 100° C. (194° to 213° F.) these germs grow in either the presence or absence of oxygen, and are capable of reproducing themselves when transplanted from nutrient media at the end of a year, and they have been found alive at the end of ten days after having been dried on a cover glass. Their natural habitat on the body is the cutaneous and mucous surfaces, although they have been found in the salivary secretions, in the dirt under the finger nails, and in the mucus from both the pharynx and nose; they have also been found in the soil, the air and water, upon the surface of fruits, and on the petals of the rose. The pus-forming quality of this coccus is beyond doubt. Von Eiselberg and Netter have shown that it is transported by the blood to other parts of the system, but there is no conclusive evidence that it multiplies within that medium. (2) The *Staphylococcus pyogenes albus* is precisely like the preceding in morphology except that it is not pigmented. Surface cultures made from this coccus are milk white, from which fact it takes its name. According to Rosenbach, who discovered it, this albus occurs more commonly among the lower animals than does the aureus. Pathologically it is often found alone in acute abscesses, but more frequently in company with other pyogenic bacteria. It is probably identical with the micro-organism next to be described. (3) The *Staphylococcus epidermidis albus* (Welch) has physical properties precisely like those of the preceding, but differs from the aureus in colour, in the fact that it liquefies gelatine more slowly, that it is less virulent when introduced into the tissues, and that it may be present in wounds without causing pus. This latter statement is made by Welch in face of the declaration that it has been demonstrated to be the frequent sole cause of suppuration along the drainage tube and in stitch abscesses. Its natural habitat is the skin, into the interstices of which it is frequently buried so deep as to be beyond the reach of the agents usually employed in hand sterilization. This was interestingly demonstrated by Dr. Thomas C. Craig, United States Navy (*New York Medical Journal*, April 11, 1896), who, in a search for malarial organisms in a fever patient, sterilized the palmar surface of the latter's finger, which he pricked deeply with a

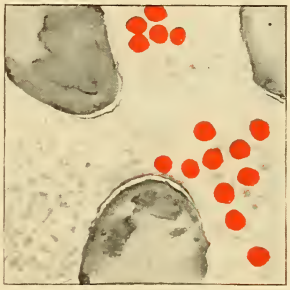

Fig. 15.—"The *Staphylococcus pyogenes aureus* is the most common pathogenic micrococcus."—Reed (page 50).

needle previously sterilized in an alcohol flame. Three drops of the resulting blood were thrown away; the top of the next drop was touched with the point of a sterilized platinum wire and a stab culture in agar made. Three cultures were thus made, two of which proved negative, while the third yielded the *Staphylococcus epidermidis albus* of Welch. While this is an isolated observation it tends to show that, even upon a palmar surface, in the absence of sebaceous glands and hair follicles, this coccus may be situated so deeply as to elude careful antiseptic precautions. (4) The *Staphylococcus pyogenes citreus*, while having morphologic features in common with other micrococci, differs from them in the particulars that its coloured pigment is of a lemon yellow, that its pigment is formed only in presence of oxygen, that it is slowest of all of the micrococci in liquefying gelatine, and, finally, that although it is found with other bacteria in acute abscesses, its own pathogenesis is undetermined.

(B) *Streptococci*, like the preceding organisms, have a common morphology depending upon the fact that, after the cocci have multiplied by binary division in a single direction, the resulting segments arrange themselves into chains (Fig. 16). The chains thus formed may be long or short, single or arranged into bundles. While there are numerous varieties of streptococci, it is necessary for this chapter to consider only the *Streptococcus pyogenes*, in which the cocci are spherical—from 0.1 μ to 1 μ in diameter—those in the same chain or in different chains varying in diameter. This streptococcus grows both in the presence and absence of oxygen and does not liquefy gelatine. Considered pathogenetically, it causes inflammation when injected into the tissues of lower animals, in some of which, notably in mice, with lowered vitality, it multiplies within the body and causes death. It is demonstrated to be the essential causative factor in erysipelas, from which fact it is sometimes designated the *Streptococcus erysipelatos*. It is also recognised as the streptococcus of puerperal fever, a fact which explains the now universally recognised causal relation of erysipelas to the latter disease. Czerniewski found this coccus but once in the lochia of 57 healthy lying-in women, while he found it in the lochia of 35 out of 38 women with puerperal fever, and in 10 fatal cases it was present in the lochia before and in the organs after death. The inference from these observations has been abundantly confirmed, especially by Clivio, Widal, Eiselberg, Emerich, and Bumm. It also plays an important part in the inflammation of mucous membranes.

Fig. 16.—"After the cocci have multiplied by binary division in a single direction, the resulting segments arrange themselves into chains."—Reed.

The *Micrococcus gonorrhœæ*, familiarly known as the gonococcus of

Neisser (Fig. 17), is a micrococcus occurring in pairs or in groups of four, but generally in the form of diplococci. Its elements are flattened or "biscuit-shaped." "The flattened surfaces," says Sternberg, "face each other and are separated, in stained preparations, by an unstained interspace. The diameter of an associated pair of cells varies from 0.8 μ to 1.6 μ in the long diameter—average about 1.25 μ—and from 0.6 μ to 0.8 μ in the line of the interspace between the biscuit-shaped elements, which sometimes present a slight concavity of the flattened surfaces. Multiplication occurs alternately in two planes, and as a result of this, groups of four are frequently observed. But diplococci are more numerous and are considered as the characteristic mode of grouping. Single, spherical, undivided cells are rarely seen." There are other micro-organisms with a morphology identical with the gonococcus, which, therefore, must depend for its distinction upon other features. Among other facts to be taken into consideration in this connection are its response to staining agents; the fact that it is aerobic; that it is a strict parasite; that in culture media it is self-limiting in its vitality; that it will not develop below 25° C. (77° F.) or above 38° C. (100.4° F.); that, exposed to 60° C. (140° F.) for ten minutes, it dies; and, finally, it is distinguished by the clinical phenomena attending its occurrence. Studied pathogenetically, it has been demonstrated to cause the form of inflammation known as gonorrhœa, upon the mucous membrane of the urethra, the cervix uteri, the corpus uteri, and the vagina of children; while the vaginal mucous membrane of adults appears to be immune. The conjunctiva is also capable of inoculation—a fact which accounts for the frequent occurrence of ophthalmia neonatorum. Bockhart has found that the gonococci penetrate into the deeper layers of the urethral mucous membrane, even into the corpus cavernosum, although Bumm is of the opinion that, as a rule, the epithelial layer of the mucous membrane is alone involved. In its later stages gonorrhœa often becomes a mixed infection, owing to the presence of the *Staphylococcus pyogenes aureus*, upon which, rather than upon the gonococcus, all metastatic manifestations depend.

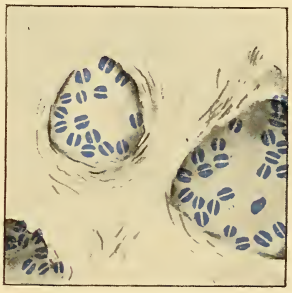

Fig. 17.—"Familiarly known as the gonococcus of Neisser."—Reed.

Bacilli.—The pathogenic bacilli, like the micrococci, have a common morphology, in the particulars that they are spheroidal, rod-shaped, or spiral in form (Fig. 18). The ends of the rods may differ, some being square, others oval, etc., the difference existing between the ends of different rods rather than of the same rods. Of the several hundred known bacilli it is necessary in this connection to consider but three—viz.: (*a*) *Bacillus coli communis*, (*b*) *Bacillus aerogenes capsulatus*, and (*c*) the *Bacillus tuberculosis*.

(*a*) The *Bacillus coli communis*, morphologically, consists of short rods with rounded ends, generally occurring in pairs (Fig. 19), about 2 μ long and from 0.4 μ to 0.6 μ broad. In some instances the diameter and the length are equal, under which circumstances they may be mistaken for micrococci. They propagate both with and without oxygen, and are both parasitic and saprophytic. They are capable of slight amœboid activity. They propagate actively in acid media of abnormal tempera-

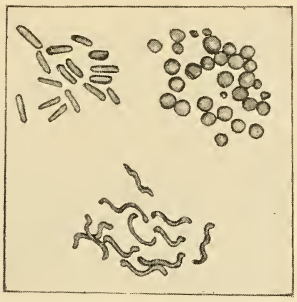

Fig. 18.—"Bacilli are spheroidal, rod-shaped, or spiral in form."—Reed (page 53).

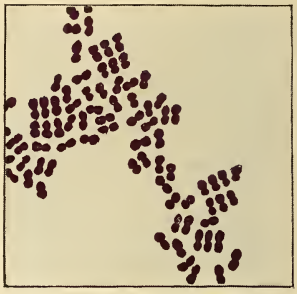

Fig. 19.—"The *Bacillus coli communis*. —Reed.

ture. There are several varieties of this bacillus, all of them possessing a common morphology though differing slightly in habitat, behaviour in similar media, and in degrees of virulence, but it is not necessary in this connection to speak of them in detail. In the normal body the habitat of the *Bacillus coli communis* is in the colon and adjacent portions of the alimentary canal. Its migration from this locus, through an infection atrium, into either the walls of the intestines or the peritoneal cavity is fraught with serious mischief. (See Bacteriology of

Fig. 20.—"The *Bacillus aerogenes capsulatus* (Welch-Nuttall.)"—Reed.

Fig. 21.—"The *Bacillus tuberculosis* (Koch.)"—Reed (page 55).

Appendicitis.) It has been found in common with other micro-organisms in puerperal fever.

(*b*) The *Bacillus aerogenes capsulatus* (Welch-Nuttall, Fig. 20) occurs, ordinarily, as a straight but sometimes slightly curved bacillus, with ends that may be square or slightly rounded, and from 3 to 6 μ in

length. It has a transparent capsule; is without the power of spontaneous movement; is sporeless; thrives without oxygen at normal temperature; and generates gas in large quantities in all culture mediums. Animals inoculated with this bacillus speedily die, the bacillus propagating rapidly and developing gas in the dead tissues. It is the bacillus most probably responsible for the gas which occasionally occurs in tissues in connection with suppuration.

(*c*) The *Bacillus tuberculosis* (Koch, Fig. 21) consists of rods from 1.5 μ to 3.5 μ long and from 0.2 μ to 0.25 μ broad. They are generally slightly curved, but sometimes angulated, and in stained specimens exhibit unstained intervals. They are usually single, but are occasionally double. They are peculiar in that they do not readily take up aniline colours, and that when once stained they do not decolourize with facility, even by strong acids. They are parasites, but under ordinary circumstances they are not saprophytic. They grow only at a temperature of about 37° C. (98.6° F.), and that they develop spores in the process of growth is not established. Koch affirms that they are killed by exposure to the direct rays of light, although Sawizky states that tuberculous sputum, under the conditions of ordinary habitation, may retain infectious power for as long as ten weeks. A fact of practical importance is that they develop a toxine which produces febrile reaction. Pathogenetically, it is sufficient for the present purpose to say that, introduced into the system, this bacillus causes tuberculosis both in the lower animals and man.

Varieties of Sepsis.—For the purposes of this work sepsis is divided into local and general.

Local sepsis implies the infection of a circumscribed area of tissue with pathogenic bacteria. Such infection results generally, but not always, in suppuration, which may be either superficial, as in ulceration, or interstitial, as in the formation of an abscess. *Suppuration* consists in the conversion of normal tissue elements into a fluid called pus. *Pus* is of variable consistence, of high specific gravity, of alkaline reaction, and of a colour varying from grayish to greenish yellow. Any variation from yellow depends upon the presence in the pus of added elements. Microscopically, pus is found to contain leucocytes, some of which are normal in size and contour, others are dead and shrunken, while still others are very large and polynuclear, and are known as giant or pus corpuscles. There are some red blood-corpuscles, frequent fat-laden cells, and some epithelial elements. Passet cultivated from pus eight different kinds of fungi, chief among which were the staphylococci, streptococci, and bacilli of various sorts; among the last, in different cases, were observed the bacillus of tuberculosis, the bacilli of glanders, of leprosy, and actinomyces. Filiaria and infusoria are also occasionally found. The crystalline elements of pus are cholesterin, hematoidin, the crystals of fatty acids, and the triple phosphates.

The treatment of sepsis divides itself naturally into preventive and

curative. Under the first head are embraced all those measures which are calculated to destroy the pathogenic bacteria existing upon the integument or upon dressings, instruments, ligatures, or sutures, and which may thence and thereby be brought in contact with such tissues as may be exposed in the course of a surgical operation. They are designed to produce a condition known as asepsis. This word deserves a little consideration; its definition, as given by Foster, is as follows:

Asepsis—from α privative and σῆψις, putrefaction; French, *asepsie*; German, *Asepsie*—means freedom from putrid or putrescent material and from septic germs.

It has come to be used, in surgical nomenclature, to imply an exalted state of ordinary cleanliness, to secure which it is not necessary to employ the usual germicidal measures and agencies. In many quarters it is accepted as true that asepsis is a very natural condition. This view is misleading and dangerous. The very contrary, indeed, may be asserted—namely, that the condition of absolute asepsis, particularly as relates to the human integument, not only does not exist naturally, but is almost impossible of attainment. This being true, the word "asepsis" should be used only to imply such a state of freedom from septic elements as can be attained by the use of antiseptic measures and agencies. As a matter of fact, all the measures and precautions usually designated under that head are directed against septic micro-organisms and are consequently measures of antisepsis. This word—from ἀντί, opposed to, and σῆψις, putrefaction (French, *antisepsie*; German, *Fäulnishemmung*)—means any procedure or combination of procedures for preventing, limiting, or stopping, putrefaction or for destroying putrefactive germs.

The attempted limitation of the meaning of "antisepsis" to the treatment of conditions of obvious infection is not warranted by its etymology or by its recognised scientific application. Those antiseptic measures which are adopted as preliminary safeguards to an operation may properly be grouped under the title of the preventive treatment of sepsis. (See Antisepsis.)

Symptoms of Local Sepsis.—When local infection occurs, it causes a circumscribed inflammation, characterized by the cardinal signs of heat, pain, redness, and swelling. In the course of a few days, if the infection has not been mastered by the action of the leucocytes, pus forms; the micro-organisms upon which it depends for its elaboration, having penetrated into the normal tissues, continue to propagate, resulting in the progressive formation of pus. This is observable in areas of infection upon the surface, as well as in the gradually increasing volume of an abscess.

Treatment of Local Sepsis.—The fact that pyogenic bacteria are inhibited at low temperatures is of practical importance in the treatment of the earlier stages of local infection. Cold, applied persistently over the seat of infection not too deep to be influenced by it, may

arrest the propagation of the bacteria until the leucocytes have had time to subdue the advance guard of invasion. Cold is, therefore, a remedy of great value in the early treatment of these cases, when for any reason it is not deemed best to open the wound and treat it by direct antisepsis. This is the course of election in the majority of cases. The focus of infection should be freely incised and washed out, first, with sterilized alkaline water, next with hydrogen peroxide, and subsequently with the bichloride solution. The wound should then be packed with bichloride gauze and changed daily. If the wound still manifests a tendency to suppurate, the fact indicates that the bacteria have penetrated too deeply to be influenced by the antiseptic agents. It is better, under such circumstances, to freely curette the wound down to the normal and unaffected tissues, then to wash it out with the peroxide, and treat it as before. Active escharotics, such as the nitrate of silver, may be used to cauterize the wound, and thus to remove the infected tissues.

General sepsis, as used in this chapter, means the intoxication of the system with some poisonous agency of bacterial origin, and includes the clinical conditions designated by *toxæmia*, *septicæmia*, *sapræmia*, *pyæmia*, etc. The state of general sepsis presupposes a point of local infection, although the local infection may not result in suppuration. There are many cases of general sepsis in which the constitutional symptoms develop and run to a fatal issue before the local infection, upon which they depend, has had time to develop suppuration. That constitutional sepsis depends primarily upon local bacterial invasion is established by (*a*) the frequency with which it follows known local infection, (*b*) the extreme rarity of its occurrence in the absence of some demonstrable nidus of infection, and (*c*) the demonstrated existence in the blood of bacteria which of necessity must have had an extra corporeal origin. Von Eiselberg has demonstrated both staphylococci and streptococci in the blood of septic patients. While the rôle that these bacteria play in the circulation can not be doubted, it has, nevertheless, been proved by Rosenbach that actual bacterial invasion of the circulation is not essential to the causation of constitutional sepsis; he concludes, on the contrary, that septic symptoms are due rather to the absorption of poisonous ferments and ptomaines. These, having their origin in a local infection, are given off and multiply more rapidly than do the micro-organisms themselves. It is this latter fact which explains the celerity with which septic symptoms develop after a local infection has occurred in cases in which bacteria can not be demonstrated in the blood. In certain cases, however, bacteria are present in large numbers, a few of them succumbing to the action of the leucocytes, while others are deposited in the terminal capillaries, where they become foci of secondary suppuration. Reed has recorded a case in which one hundred and twenty-four secondary, or metastatic, abscesses occurred, in which the patient finally recovered.

Symptoms of General Sepsis.—In considering the symptomatology of septic constitutional states it may be well to distinguish between those clinical entities designated as septicæmia and pyæmia. In septicæmia the fever curve, which may begin without an initial chill, gradually rises almost without vacillation until it is arrested within the thermic range of life, or else until it passes that point and death ensues. Those cases in which the system has sustained injury, such as strangulated hernia or gunshot wounds of the abdomen, and, where death is said to be due to septicæmia, in which the temperature has been under rather than above the normal line, are to be classed as cases of shock rather than of septicæmia. Prostration, headache, anorexia, with lassitude and stupor, supervene. Diarrhœa is common; lymphatic engorgement is generally detectable; the skin is pale and sometimes reveals a slight scarlet eruption. The skin in the earlier stages is parched, but later the perspiration becomes active, with increasing sallowness of complexion, increasing listlessness, increasing weakness and rapidity of the pulse, and diminished urinary secretion; from the initial chill, through the whole course of the disease, the pulse shows increased frequency with diminished force, until it disappears at the wrist; delirium obtunds the consciousness until coma merges the patient into death. In pyæmia the symptoms do not set in so speedily after operation, generally not until the second week. They begin with a chill followed by sudden rise in the temperature line. The subsequent course of the disease is characterized by a repetition of the chills, followed in each instance by a rise of temperature. The periodicity between these exacerbations is characterized by marked irregularity. The fall, however, rarely if ever reaches the normal line. About this time metastatic abscesses manifest themselves. These may occur in the subcutaneous connective tissue in some superficial lymphatic in the neck or groin; purulent effusions into the pleura or into the joints may occur. The parotid and other glands are liable to infection. The mind, however, generally remains clear, and in those patients who go to a fatal termination, death seems to supervene upon progressive exhaustion which finds its climax in arrest of the cardiac function.

Treatment of General Sepsis.—In the management of general sepsis the treatment is essentially antiseptic. (For preventive treatment see Antisepsis.) In septicæmia immediately following abdominal section but little good can be accomplished by reopening the abdomen, although cases have improved following this treatment. When the abdomen is reopened, in those cases in which a discriminating judgment prompts the operation the peritoneum should be thoroughly washed with a normal saline solution and a drainage tube should be inserted. The constitutional state should be combated by supportives. The early occurrence of vomiting, however, and its persistence will generally interfere with the administration either of remedies or nutrition by way of the stomach. Rectal alimentation should, therefore, be resorted to; when the stomach will permit of their exhibition, copious

quantities of stimulants should be given. Heart stimulants, such as strychnine, digitalis, and, in later stages, nitroglycerine, are of value. Normal salt solution, given either by hypodermoclysis or by intravenous injection, has been observed to furnish a needed volume to the circulation and to re-enforce the patient's strength. The various antitoxic serums have not yet yielded the benefit that it was hoped would be derived from their employment, the theoretic explanation of the difficulty being that, whereas the serum was derived from the cultures of individual varieties of bacteria, infections are generally of the mixed variety, in the presence of which the special serum is relatively powerless.

CHAPTER VIII

ANTISEPSIS

Antiseptic provisions of Nature—Sterilization: (*a*) Mechanical means, (*b*) heat, (*c*) germicidal agents—The nurse—The room—The patient—Instruments and dressings—Sutures and ligatures—Post-operative antisepsis—The surgeon: Hand sterilization; gloves.

Antiseptic Provisions of Nature.—The word antisepsis, as previously defined, implies any provision or procedure for limiting or stopping putrefaction or for destroying putrefactive germs. Nature herself has provided a double protection against invasion by pathogenic micro-organisms. The first of these provisions is expressed in what has come to be recognised as the law of Wyssakovitsch—viz.: that the epithelial cells covering any part of the body, while they maintain their integrity, protect the underlying structures and the general system against bacterial invasion. The second of Nature's effective provisions is expressed in the law of Metschnikoff—viz.: that in the presence of bacterial invasion the leucocytes, both uninuclear and multinuclear, acting as phagocytes, attack and destroy the invading micro-organisms. All bacterial invasions of the body, therefore, can be said to take place only in the presence of an infection atrium, which implies the destruction of a greater or less area of protective epithelium; and systemic contamination can not result until the invading bacteria, like a numerous army, has assailed and overcome the defending leucocytes. When, however, it is deliberately intended to make an infection atrium in the form of a surgical incision, and when it is contemplated thereby to establish circumstances so favourable to infection that the defending leucocytes must necessarily be overpowered, it becomes imperative to practise those safeguards which are conventionally designated by the word antisepsis. They embrace various methods of destroying micro-organisms which are known to exist upon the hands of the surgeon or his assistants and upon or within the integument of the patient; that cling to instruments; that infest materials utilized for sponges and dressings; or that exist in great abundance in the clothing and immediate surroundings of the patient.

Sterilization, by which is implied destruction of micro-organisms in a given area or substance, is effected by (*a*) mechanical means, (*b*) heat, generally combined with pressure, and (*c*) chemical agents.

Mechanical sterilization is practised by careful and prolonged washing with a detergent, and by heavy friction. Soap is the best detergent, but care should be taken that it is not itself contaminated. Frequent researches have shown that soap may be thoroughly infested with bacteria. The danger from this source can be overcome by taking either the ordinary lye soap of the kitchen or the laundry, or, preferably, a known variety of pure soap, such as the ivory, diluting it with water, and boiling it for twenty minutes. This insures resterilization, should the soap have previously become contaminated. Brushes made of vegetable fibre are the best. (See Sterilization of the Hands.) Gauze material, purchased for use as sponges or dressing, particularly cheese cloth as obtained in the stores, contains starch; it should, therefore, be washed carefully with soap as above prepared, and after being rinsed through sterilized water should be dried. This can be done either before or after the material has been made into the individual sponges or dressings, but in either event they must be subjected to resterilization before being used. (See Sterilization of Instruments and Dressings.) Filters, such as the Pasteur-Chamberlain, are of doubtful efficacy in separating micro-organisms from the water that passes through them.

Sterilization by Heat.—Heat is utilized for the purpose of sterilization in the form of both dry heat and moist heat and in the form of heat combined with pressure. Heat by itself, whether dry or moist, is sufficient if applied in high enough degree, to destroy bacteria, but it is not practicable at the same time to destroy the spores frequently given off by the micro-organisms. To destroy the spores at the same time that the bacteria are killed, it is generally necessary to employ heat under pressure. The germicidal property of heat depends upon the fact that all micro-organisms have a thermal death point varying from 52° C. (125.6° F.) to 64° C. (147.2° F.). It is not necessary in this connection to study the powers of resistance to heat possessed by different bacteria; but it is sufficient for practical purposes to rely upon the fact that exposure to a boiling temperature for ten minutes "will infallibly destroy all micro-organisms in the absence of spores when they are in a moist condition or moist heat is used." (Sternberg.) Spores, however, have greater powers of resistance, and some of them are not destroyed even after exposure for several hours to a boiling temperature. To destroy these reproductive bodies recourse is had either to interrupted sterilization—i. e., resterilization after twenty-four hours—or to a single sterilization under pressure. The latter method is generally employed in America, and consists in introducing the objects to be sterilized into a steam chamber into which steam is projected until a pressure of at least forty pounds is reached. The sterilizer devised by Col. John Fehrenbatch (Fig. 22) and used in the Cincinnati Hospital, consists essentially of a cylinder surrounding a sterilizing chamber, the double wall of which incloses a space (*H, H,* Figs. 23 and 24) half an inch across. Steam is forced into this hollow space at a pressure of fifty pounds per square inch—ten pounds

greater than that used in the sterilizing chamber—which keeps the walls at a temperature from six to ten degrees higher than that inside. This prevents a condensation of steam by the walls and, together with an arrangement by which the steam is prevented from coming into contact with the dressings until it has traversed the whole space between the two cylinders, makes it unnecessary to dry the dressings before use.

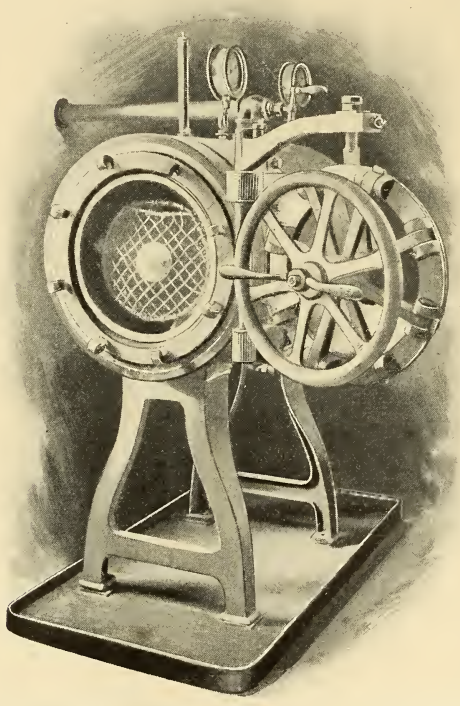

Fig. 22.—"The sterilizer devised by Col. John Fehrenbatch."—Reed (page 61).

The wire receiving basket is supported by flanges (*K*, *K*, Fig. 24), which keep it away from the walls of the chamber, allowing the steam to penetrate freely from all sides, and it has been found that the temperature at the centre of a tightly wound package twelve inches in diameter is the same as that on the outside of the package.

Any desired pressure, up to one hundred pounds, can be maintained by an invisible, automatic arrangement while the steam is kept in constant circulation at the same time. The mechanism for closing the head makes it possible to secure a steam-tight joint in three seconds, the whole process of thorough sterilization consuming about fifteen minutes.

All dressings, sponges, operation gowns, etc., should be sterilized, when practicable, by this means, while instruments should be boiled for ten minutes in water containing two drachms of powdered carbonate of sodium to a quart of water. This solution has the double advantage of dissolving the capsule, which acts as a protective to some germs, and of keeping the instruments from rusting. (See Sterilization of Dressings and Instruments.) Dry heat, involving, as it does, the desiccation of the micro-organisms, must be carried to a higher degree than is the case with moist heat. The temperature of 140° C. (284° F.), maintained for three hours, is required to destroy the spores of bacteria.

Sterilization by Germicidal Agents.—Various salts, essential oils, and gases, have the property of destroying bacteria. The germicidal property of these different agents presents the widest range of variation. Those of the greatest value, mentioned in the order of their germicidal power, are mercuric iodide, silver iodide, hydrogen peroxide, mercuric chloride, silver nitrate, chlorine, iodine, bromine, carbolic acid, potassium permanganate. Some agents that have the highest germicidal power are of no practical value in surgery, because they destroy the tissues with which they are brought into contact. For practical purposes lysol or carbolic acid in a two-per-cent solution, or the mercuric chloride (1 to 2,000), is all that is required.

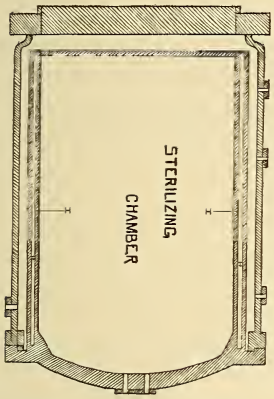

Fig. 23.—"The sterilizer devised by Col. John Fehrenbatch . . . consists essentially of a cylinder surrounding a sterilizing chamber, the double wall of which incloses a space half an inch across."—Reed (page 61).

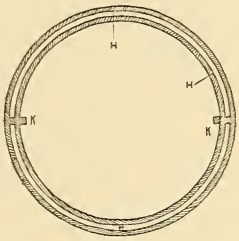

Fig. 24.—"The wire receiving basket is supported by flanges which keep it away from the walls of the chamber, allowing the steam to penetrate freely from all sides."—Reed (page 61).

Peroxide of hydrogen is of value in removing possible infection from exposed tissue areas. Among the various detergent agents it is desirable to select those which have germicidal properties, such as turpentine, the oil of cedar, or alcohol. For dressings, boric acid, iodoform, and aristol, have a demonstrated value; although in aseptic wounds with accurate coaptation of the margins, antiseptic agents are not generally required, the protective influence of the leucocytes and of the carefully adjusted sterilized dressing subserving all purposes against infection.

The Nurse.—Those measures which are devised and practised for the prevention of sepsis, and which contemplate the sterilization of the hands of the surgeon and attendants and of the field of operation, of sponges, dressings, and instruments, as well as of the patient's immediate environment, involve the exercise of so much special knowledge and skill that they must be intrusted to a person of special training. In recognition of this fact, the leading hospitals of the world have been engaged during the past fifteen years in giving special courses of instruction and training to that class of women who have come to be known as graduate nurses. The services of the trained, or more properly the graduate nurse, are essential to the successful practise of aseptic surgery. She should be the possessor of bodily vigour, preferably comely, of pleasant address, with an interest in her work, prompted both by a love of humanity and pride in her profession. Such a person

in these latter days is thoroughly familiar with sepsis, its cause and prevention, as well as with surgical technique. With a mere statement of the operation intended, she may be left without further instruction to the preparation of the case and its surroundings. The nurse should always be equipped with not less than three uniforms, a number of aprons, catheters, rectal tubes, syringes, thermometer, and hypodermic syringe, the last named being the one article which can best be spared from her armamentarium. She should always have a plentiful supply of antiseptic tablets. She should also provide herself with record blanks and should keep a careful record of every essential fact relating to the preparation or the progress of the case.

The Room.—It is always more desirable to operate in a well-conducted hospital, although any residence is a safer place for surgical work than is a poor hospital. *In hospitals* the operating room may be said to be the distinguishing feature. It is an apartment set aside exclusively for operations, and is constructed of impervious and thoroughly washable walls, floors, and ceilings. It is arranged with reference to satisfactory light, proper drainage, and the maintenance of a high and equable temperature. It is furnished with only sterilizable furniture and fixtures, consisting of glass-topped enameled tables upon which to place the patient, the instruments, sponges, etc. Incandescent lights are so arranged that the field of operation can be illuminated by that means, if required by circumstances of emergency. The operating room is sometimes constructed to contain the sterilizing apparatus, but this is better done in an adjoining apartment, specially furnished and otherwise adapted for the purpose. It is desirable also to prepare the patient in an apartment adjacent to the operating room and containing special appliances for the purpose. *In private residences* an effort should be made to reproduce as nearly as possible the more ideal conditions of the hospital. The circumstances of the ordinary home, however, are all adverse to this realization, and enjoin upon the nurse the most serious responsibility in overcoming them. She should begin by having all furniture, including pictures and hangings, taken from the room; the walls, floors, and ceilings, should then be carefully wiped with a moist bichloride cloth, after which the floors, windows, and especially the doors and door knobs, should be scrubbed with a 1-to-2,000 bichloride solution. Each article of furniture that is thereafter brought into the room should be cleaned as thoroughly as possible before it is returned, and again gone over with a bichloride cloth after being brought in. The most important article of furniture to be considered in this connection is the operating table. In the absence of a special table, one answering the purpose very well can be extemporized by utilizing an extension table such as is found in practically every dining room. This should be thoroughly scrubbed before it is brought to the operating room, and it should be set up by extending it a distance of about $2\frac{1}{2}$ feet, and by taking two of the boards, or leaves, ordinarily used in the table, and placing them lengthwise upon the top,

their ends resting upon the now extended ends of the table. A blanket, folded lengthwise, can now be placed over these boards, but extending the whole length of the table. Above this should be placed some protective material, such as oilcloth rubber sheeting, or, in the absence of anything better, a number of newspapers, and over all a sterilized sheet. Sterilized towels may be placed over the corners of the table between which, upon opposite sides, will stand the surgeon and his assistant. This arrangement makes a really convenient operating table, and one that is not too broad. Another kind of table, easily extemporized by a carpenter or a handy man about the place, consists of two trestles, 32 inches high and about 18 inches wide. On these is placed a board from 12 to 18 inches in width; on this board is placed another and shorter one, bevelled at one end and surrounded at the other by a piece of iron fastened midway in the edge upon either side by screws. The bevelled edge of this board, resting against two screws set in the lower board, and elevated at the other end, will be supported by this iron brace, resting against some screwheads, thus making a very desirable and convenient Trendelenburg attachment (Fig. 25). Smaller

Fig. 25.—"A very desirable and convenient Trendelenburg attachment."—Reed.

tables or stands should be provided for bowls, instruments, etc. At least four wash bowls should be provided and a dozen or more towels. Two pitchers, one containing hot and the other cold sterilized water, and two larger receptacles for a reserve supply of hot and cold water, should be provided. One wash bowl should be used for the preliminary

ablution of the hands, the other should contain some alcohol, and a third the bichloride solution. The room should be maintained at a temperature of about 85° F.

The Patient.—The patient having been given the preliminary laxative and general bath described more in detail in the chapter on Abdominal Section, is divested of her clothing and is placed between sterilized sheets. If she is able to take a general bath in a tub as an intermediate step, so much the better; but if she is not able to do this she should be given a general sponge bath, care being taken to avoid chilling her. After the general bath the pubes and pudendum should be shaved. They are then rinsed thoroughly with soap and water. The patient is next given a careful vaginal douche consisting first of clear water; while this douche is in progress the nurse should insert into the vagina some soap, and with her finger thoroughly wash the vaginal walls up to the uterine juncture. After a half gallon of plain hot water has been used in the douche the vagina should be irrigated with a hot bichloride solution (1 to 2,000). The abdomen should then be exposed and thoroughly soaped. The skin should be vigorously scrubbed for ten minutes with a brush. This is a manipulation the proper performance of which requires judgment on the part of the nurse. A nurse who does not understand her business will simply follow directions to the letter and will scrub the skin with a rough brush for ten minutes regardless of consequences. It is important to remember that undue pressure is unnecessary for the proper cleansing of the skin, and is liable to do damage to the internal inflamed organs; while pressure which is too vigorous will rub off patches of epithelium. This should be carefully avoided, as every area of abrasion may become an infection atrium. After thoroughly washing the abdominal wall, any remaining fatty material should be removed by the use of either ether or alcohol. The alcohol should be clean and fresh. The solution of mercuric bichloride (1 to 2,000) should then be applied, first in the form of an ablution, and finally in the form of a pack, consisting of a towel saturated with the bichloride solution, covered with other towels, and kept in position by a retaining bandage. In cases of operation upon the perineum or the vagina practically the same precautions should be taken with regard to the pudendal integument. The final moist dressings, comprising the last step in the process of sterilization, should be kept in position until the patient is placed upon the operating table. The nurse with her own hands, previously resterilized, then removes the preparatory dressings, and again washes the abdomen with alcohol, followed by the bichloride solution. All of the bichloride solution thus used should be carefully absorbed by sterilized sponges; otherwise, by remaining upon the surface of the abdomen, it is brought in contact with the surgeon's blade to the almost instant ruin of its edge.

Instruments and Dressings.—Sponges are but rarely used in abdominal and pelvic surgery, the preference being given to small pieces of

gauze, which after being used to absorb blood or discharges are instantly thrown away. There is no doubt that this change has marked a distinct advance in aseptic surgery. Dressings are made of the same material. In hospitals both sponges and dressings of gauze are made in large quantities and are sterilized by washing (see Mechanical Sterilization) and by being subjected to heat under pressure in a steam sterilizer. In private practice it is better to secure a bundle of sponges and dressings that have been thus sterilized, but when this is not practicable, it is better, after washing, boiling, and drying the material, to make it up into sponges and dressings, which are then to be resterilized in a bundle by putting them into the oven of the kitchen stove, where they are permitted to bake until the outer covering is thoroughly scorched, the heat having been maintained for not less than half an hour.

Sutures and Ligatures.—Sutures are used to approximate margins of a wound, and consist usually of silk, catgut, silkworm gut, silver wire, or iron wire. These materials are all now susceptible of being sterilized by heat, with the exception of catgut; simple boiling in plain water will answer the purpose. Ligatures are used for hemostatic purposes and consist of silk and catgut.

Catgut, as known to commerce, is prepared from the intestine of the sheep, and its use in surgery has been designated by Nussbaum as Lister's greatest discovery. It has the advantages of being strong, flexible enough to be tied into a safe knot, capable of complete sterilization, and completely absorbable when left either within the peritoneal cavity or the parietal structures. Since the secret of its sterilization has been discovered, it possesses no disadvantages that are worthy of consideration. It was formerly looked upon as a fertile culture medium when left in tissues that were previously the seat of infection; it was justly recognised as being difficult of sterilization; and it was urged against it that it was liable to become absorbed too soon. With Hofmeister's formula, however, all these objections are at an end. This formula, which has been popularized in America through the influence of Nicholas Senn (*Medical Mirror,* January, 1897), is given by him as follows: "(1) The catgut is wound on a glass plate with slightly projecting edges, so that the gut is free from the sides of the plate and exposed to the circulation of the boiling and flowing water. The ends of the gut are fastened through holes in the plate. (2) Immersion twelve to forty-eight hours in aqueous solution of formalin, two to four per cent. (3) Immersion in flowing water at least twelve hours, to free the gut from the formalin. (4) Boiling in water from ten to thirty minutes. Ten to twelve minutes is amply sufficient, as all microbes and spores are killed by exposure to boiling heat for that length of time. (5) Hardening and preservation in absolute alcohol containing five per cent of glycerine and one tenth of one per cent of corrosive sublimate." Senn modifies the above formula by boiling the deformalinized catgut from twelve to fifteen minutes, after which it is cut into pieces of desirable

length, and tied into small bundles containing from 6 to 12 threads, which are immersed and kept ready for use in the following mixture: Absolute alcohol, 950; glycerine, 50; finely pulverized iodoform, 100. The alcohol dissolves part of the iodoform, which is presumed to add to the antiseptic value of the solution. Senn states that iodoform applied to recent wounds diminishes the amount of primary wound secretion. This, however, is contrary to the experience of Reed, who has found less wound secretion from catgut prepared according to Hofmeister's formula, but preserved in Senn's fluid with iodoform left out. The absolute alcohol of itself is a safe precaution against the infection of the catgut. Goldspohn has had satisfactory results from catgut which, after being prepared by the Hofmeister formula and deformalinized in running water for forty-eight hours, was boiled for twenty minutes in a 1-to-1,000 solution of pyoctanin in water, the excess of pyoctanin being washed out and the catgut preserved in plain alcohol. The tendon from the kangaroo's tail has been introduced into America, while those derived from the legs of the reindeer (ostiakes) have been used in Russia. They are very strong and slow of absorption, and seem to have had a special claim for consideration as sutures in operations for hernia, etc., in which it is desirable to maintain their retentive power as long as possible. The present method of preparing catgut, its cheapness, and general desirability, however, leave no excuse for the continued employment of tendons as either ligatures or sutures.

Post-operative Antisepsis.—In the presence of an aseptic wound there is nothing to do but to restrain the curiosity. Where there is no febrile reaction, no pain in the wound, no pulsation in the seat of operation, it is safe to leave the wound alone until the eighth day. If buried animal sutures have been employed, the dressings can be left on with saftey from ten to fourteen days. If, however, interrupted nonabsorbable sutures have been employed, the dressings should be taken down not later than the eighth day with the object of removing any sutures that may threaten to do mischief. When, however, the patient has fever and complains of pain and throbbing in the wound, which shows a tendency to increase rather than to subside, the dressings should be taken down and the wound should be reopened at any point that may be indicated by redness or tension. Pus will thus be revealed. When this occurs, particularly in a hospital, it should be accepted as a circumstance of serious importance, threatening alike the lives of other inmates and the reputation and usefulness of the institution itself. A pus case may be the focus of an infection that, in the absence of an intelligent discipline thoroughly enforced, may result in the infection of the entire institution. More than one hospital is thus thoroughly infected, the surgeons in charge wondering why they can no longer secure aseptic results. The micro-organisms of pus are hidden foes that may lurk anywhere that can be touched by infected hands, to be carried thence by other hands to infect yet uninfected fields. To avoid this calamity, a pus case should be isolated by being put into a

room by itself in charge of a special nurse, under the care of a special interne, neither of whom should be allowed to come in contact with noninfected cases. Dressings should be removed with the utmost care to protect the bedclothing and the patient's garments, to say nothing of the nurse's hands, from contamination. Long dressing forceps should be used, and dressings or sponges employed in the course of the case should be deposited in a large granite basin.

The Surgeon.—The antiseptic precautions to be observed by the surgeon devolve with equal force upon his assistants, including the nurse. The surgeon, to begin with, should possess the instinct of cleanliness, or else he should be deprived of his license to practise. The success of the surgeon in aseptic surgery is directly proportionate to the extent to which he possesses this instinct and is actuated by it; it must be the dominating impulse of his work, and no amount of technical training can entirely make up for its absence. Important as is this instinct, it needs to be directed by intelligence and crystallized into habit. The discipline necessary for this purpose is a severe one. It has its beginning in habits of personal cleanliness, including frequent bathing, repeated ablutions of the hands, and painstaking supervision of the finger nails; but the exactions of surgical asepsis require even more than this.

Hand sterilization has been, and remains, one of the perplexing problems of the new *régime*. The fact that various micro-organisms, notably the *Bacillus epidermidis albus*, find their way into the deeper epithelial folds of the skin, where they are beyond the reach of chemical antisepsis, has furnished the chief difficulty. The method of hand sterilization at present practised by the majority of surgeons is as follows: The hands are soaked for a period of twenty minutes in soapsuds, made of sterilized soap. The ablutions extend to the elbow and are associated with friction with a stiff brush, preferably of vegetable fibre. At the expiration of this time, the water having been changed repeatedly, the plug is taken from the bottom of the washstand and the hands and arms are washed for another period of five minutes with a fresh sterilized brush under a stream of running tepid water. The direction in which the friction should be applied is of importance, it being essential that the brush should be moved in the direction of the cutaneous folds. The hands are now washed in either ether or alcohol, which should be fresh. The habit of some hospitals of saving alcohol used for hand washing is not only of questionable economy, but is a proceeding only a trifle less filthy than saving wash water. After the ether or alcohol bath the hands are rubbed for a few minutes in a solution of 1-to-2,000 mercuric bichloride.

Another method of hand sterilization, introduced by Schatz, of Rostock, consists in the usual preliminary washing, as already described; the hands are then immersed for several minutes in a saturated solution of potassium permanganate; they are then washed in a saturated solution of oxalic acid, after which, chiefly to remove the yellow

staining induced by the permanganate and but slightly modified by the oxalic acid, the hands are washed in limewater, or preferably in hydrogen peroxide. The hydrogen peroxide is used by Warren, of Boston, and may be said to be the redeeming feature of the entire formula, as it possesses not only cleansing but antiseptic properties vastly in excess of the other ingredients.

In cases in which the hands have become unexpectedly contaminated by being immersed in live pus, and in which it is necessary to proceed to a succeeding operation under otherwise aseptic surroundings, the question of immediate hand sterilization becomes an exceedingly important one. Under these circumstances, after carefully washing and rinsing the hands, they may be bathed in ninety-eight per cent carbolic acid for a few seconds. This agent is naturally an escharotic, but the epithelium is sufficient to resist its action for the brief time involved in its application, after which it is thoroughly neutralized by washing the hands in pure alcohol. Reed has repeatedly adopted this measure with satisfactory results. Sänger (*Centralblatt für Chirurgie*), after thoroughly washing his hands, immerses them in a warm solution of from two to five per cent of hydrochloric acid, and then in a one-half to two-per-cent solution of permanganate of potassium. The discoloration thus produced is removed by a bath of sulphurous acid. The chemical changes resulting from the contact with these different agents cause, among other things, the liberation of free chlorine, oxygen, and sulphurous-acid gas, all of which possess germicidal properties in high degree. Bacteriological studies of this method and its results by Krönig and Paul confirm its usefulness. Chlorine gas is a most valuable disinfectant for the hands; and a convenient method of its application, popularized by Weir, is to wash the hands with a chloride-of-lime paste for a few minutes, subsequently rinsing them in sterilized water. With all of these methods, however, some failures are reported, showing that hand sterilization by chemical means has not attained perfection.

To obviate the results following on what seems to be an insurmountable difficulty, the expedient has been hit upon of operating with covered hands. *Gloves* have been introduced by Halstead and Mikulicz, to the latter of whom is probably due the credit of establishing their use in a systematic way. Cotton and silk gloves have been used, but Lockett (*Philadelphia Medical Journal*, February 11, 1899) has demonstrated that permeable gloves become speedily saturated with micro-organisms, which observations have been confirmed by Pfahler. Thin rubber gloves are now made that are impermeable, that interfere but slightly with sensation, and that are capable of complete sterilization by boiling. After they have been worn a few times they seem to offer no serious impediment to dexterity. In speaking of their use, Kocher (*Philadelphia Medical Journal*, June 10, 1899) advises as follows: "Avoid touching with uncovered hands any infective or septic material *between* the operations, or wash it carefully away at once, cut your nails as short

as possible, brush your hands thoroughly with hot water, soap, and alcohol (85 to 95 per cent), avoiding any poisonous disinfectant before you operate, and, if you wish to be very careful, put on cotton, silk, or, better still, rubber gloves when you touch the threads for ligatures and sutures, and when you have to tear the tissues much and to rub your fingers in the depth of a wound."

A pan filled with a strong bichloride solution, or, still better, a paper receptacle, such as a cornucopia, should be used to receive the soiled dressings, receptacle and all being burned at the conclusion of the *séance*.

CHAPTER IX

SHOCK

Definition—Pathology—Causes—Symptoms—Diagnosis—Treatment: Prophylactic, restorative.

Shock is an inhibition, more or less profound, of practically all of the vital functions, due to defective vasomotor nerve control and characterized by diminished cardiac force, lessened arterial tension, embarrassed respiration, muscular relaxation, the more or less complete arrest of glandular activity, and mental lethargy, verging in the later stages into delirium.

Pathology.—Shock must manifestly be regarded as a neuro-paralysis, in which there is evident fatigue or exhaustion of the nerve centres, the result of profound and generally sudden irritation of some part of the sympathetic nervous system. This irritation may be physical, as in the case of a blow over the solar plexus, or it may be mental, as in the frequent examples of intense fright.

Causes of Shock.—Pain and fright, as already indicated, may be causes of shock. Every operator of extensive experience has seen cases in which the symptoms of shock were more pronounced before the operation began than after it was concluded, the cause evidently existing in the extreme apprehensions of the patient. In abdominal and pelvic surgery, shock is of such frequent occurrence that its causes, under such circumstances, are worthy of special consideration. According to the brilliant investigations of Dr. George W. Crile, of Cleveland (*American Gynecological and Obstetrical Journal*, 1898), which are confirmed in practically every detail by clinical experience, we learn that, even under profound anæsthesia, the symptoms of shock may be induced by (*a*) opening the abdominal cavity; (*b*) the mere exposure of the abdominal viscera to the atmosphere, the profoundness of the shock varying inversely to the temperature of the air; (*c*) manipulation of the peritoneum and underlying organs, the intensity of the shock increasing as the manipulations extend from the pelvis to the diaphragm; (*d*) disturbance of local splanchnic vasomotor areas; (*e*) pressure upon important splanchnic veins, especially upon the vena cava; (*f*) hemorrhage to a degree sufficient to lessen circulatory tension. Phenomena of shock are induced more readily in youth and old age.

Symptoms of Shock.—Shock is characterized by the sudden onset of symptoms, the most pronounced of which is general physical depres-

sion. The surface becomes blanched; the features are pinched and distorted, sometimes beyond recognition; the cutaneous temperature is lowered; the hands and fingers are shrunken and the nails are of a bluish colour; the pulse becomes feeble and accelerated; the respiration irregular; the muscular tone is diminished; the sphincters frequently are relaxed; the patient becomes faint, lethargic, and often drifts into unconsciousness. In this condition there is an arrest of all secretory and excretory functions. These symptoms, in the aggregate, are generally of short duration. If they become more intense they speedily terminate in death; if reaction sets in, the respiration improves, normal colour returns to the skin, in which the transpiratory function shows evidence of re-establishment, the heart improves in force and rhythm—probably the initial change in the return to the normal state —and the mental functions resume their sway.

Diagnosis of Shock.—The diagnosis of shock is made primarily upon the consideration of the foregoing symptoms. It is important, however, to distinguish it from several conditions with which it is frequently confused. *Hemorrhage* presents many symptoms in common with shock. In hemorrhage, however, there occur, as distinctive features, an anxious but intelligent expression of the face; extreme restlessness, manifested especially by tossing about of the arms; and frequent attacks of syncope, in the intervals between which the patient regains consciousness. To the experienced and attentive observer, one of the most characteristic symptoms of hemorrhage is a pulse of increasing frequency with diminishing force and volume, imparting to the sense of touch the impression that the heart is working without appreciable resistance. *Acute septic poisoning* in its symptomatology is often confused with shock. These cases occur especially in abdominal surgery, and their proper diagnosis depends upon, first, the fact that they have been preceded by circumstances of, at least, possible septic infection; next, the gradual development of the symptoms; and, thirdly, the temperature range, which in the earlier stages is generally characteristically vacillating, but later runs very high. In these cases the temperature of the surface may be subnormal, while that which is registered, either in the mouth, the rectum, or the vagina, may reach 104° F., or even higher. The majority of cases of "insidious shock" and of "delayed shock" belong to this class. *Syncope*, or fainting, is regarded by some as a form of shock. According to Warren, however, it is to be regarded simply as an acute cerebral anæmia, the essential symptoms of which—namely, preliminary nausea, ringing in the ears, and dizziness, followed by a fainting fit during which the patient is temporarily unconscious—distinguish it from shock. *Emboli* of various sorts produce symptoms analogous to shock; thus, Warren states that acute suppurations in tissues rich in fat may produce fat emboli, by which it is implied that the fluid fat liberated by the suppurative process may be taken up by the lymphatics and carried by them into the circulation. These emboli are most frequently deposited in the lungs.

From this locus they are generally reabsorbed and distributed to various parts of the system. When large amounts of the fat, however, accumulate in the lungs, it may induce alarming symptoms or death. "The symptoms of this complication," says Warren, "which occurs within twenty-four or forty-eight hours after an injury, are sudden pallor, irregular heart action, dyspnœa, perhaps hemoptysis, or convulsions and death. Fat will be found in the urine." Air embolism consists of the introduction of air into the veins. In small quantities air in the veins produces no injury, but when, according to Hare, a pint or more of it is introduced into the circulation, it proves fatal. Under these circumstances the heart becomes filled with air and can not contract, when death, attended with symptoms of syncope, is instantaneous.

Treatment of Shock.—The treatment of shock resolves itself into (*a*) prophylactic, and (*b*) restorative.

The *prophylactic treatment* of shock should be carefully considered in all cases in which patients of lowered vitality are about to be subjected to surgical operations. In such cases the prolonged fasting and violent catharsis, frequently practised in preparing a patient for operation, are calculated to still further reduce the strength and should be avoided. To such patients a mild cathartic may be given with advantage, although in extreme instances it is better to rely upon enemas to evacuate the bowels. The usual fast preceding the operation should also be omitted, and the patient be given a free liquid diet of milk, if well tolerated, or, still better, of bouillon, or of chicken broth, given hot, to within a few hours before the operation. As a rule, under such circumstances, alcoholic drinks of whatever variety are damaging alike to the stomach and the general system, and should be avoided. After the patient has been placed upon the table, and during the period between preliminary unconsciousness and surgical anæsthesia, eight ounces of normal salt solution should be injected under each mammary gland. This practice of hypodermoclysis is adopted by Reed, as a matter of routine, in all cases of extreme debility, or in which there is reason to expect considerable hemorrhage during the ensuing operation. A small dose of a sixtieth of a grain of strychnine may be given hypodermically at this time, or even earlier. Injections of large quantities of normal salt solution into the rectum, just preceding an operation, while theoretically of value, generally prove worthless, as they are usually expelled before any considerable quantity can be absorbed. Special care should be taken in debilitated cases to keep the extremities warm, to protect the patient from currents of air, and to have the temperature of the operating room as high, at least, as the normal bodily temperature. Another prophylactic measure of importance is Turck's rubber sack filled with hot water and introduced into the abdominal cavity during an operation (Fig. 26).

The *restorative treatment* of shock consists in bringing every available influence to bear upon the re-establishment of the inhibited vital functions. As the sympathetic nervous system seems to be the pri-

mary factor in producing those phenomena which, in the aggregate, we call shock, it is imperative that its functions be re-established as speedily as possible. With this object in view, heat should be applied, both over and within the stomach. A hot-water bag, a hot stove lid, carefully wrapped, or any other heated object, not too heavy, should be applied over the region of the solar plexus. To apply heat within the stomach, recourse may be had to Turck's intragastric resuscitator (*Journal of the American Medical Association*, January 11, 1896), which is constructed on the principle of a recurrent catheter. This is introduced into the stomach, which is then subjected to continuous irrigation with hot water at a temperature of 130° F. Heat should be applied to the extremities. For this purpose flannels wrung out of hot mustard water are of value. Friction applied to the extremities may be practised, but is of less value than moist heat associated with mild cutaneous irritants. Among the remedies valuable in these cases are to be mentioned amyl nitrite, given by inhalation, and nitroglycerine, one one-hundredth of a grain, given hypodermically, both of which are almost instantaneous in their results. They are equally evanescent in their effects, which may be made more permanent by the coincident administration of strychnine, one-twentieth of a grain; but this latter remedy should not be repeated in less than an hour, as its lethal effects may be induced by a comparatively small dose in cases of shock. Crile found that the aqueous extract of suprarenal capsules of sheep caused an immediate and marked rise in blood pressure, which effect was evanescent, the fall being as rapid as the rise. In view of the urgent necessity for oxygen in these cases, Crile esteems artificial respiration as of undoubted importance, and has recorded observations of its salutary effect upon the vasomotor and heart action, and hence upon blood pressure.

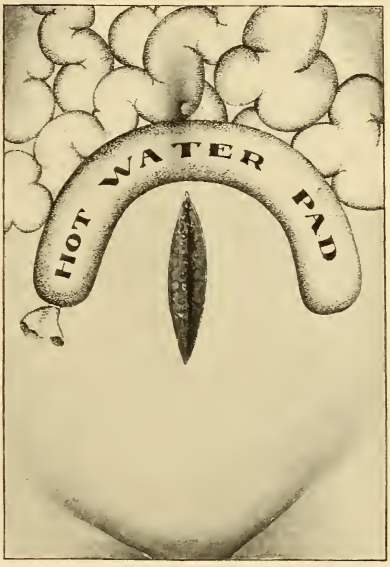

Fig. 26.—"Another prophylactic measure is Turck's rubber sack filled with hot water and introduced within the abdominal cavity."—Reed (page 74).

Normal salt solution, injected in large quantities under the skin, or thrown directly into the veins, is a remedy of extreme value in the treatment of shock, particularly when associated with hemorrhage. The solution is prepared by dissolving a drachm of chloride of sodium in a pint of water. In the absence of the chemically pure chloride of

sodium, common table salt may be employed, and while it is always desirable to use sterilized water, these cases are generally of such emergency and occur under such circumstances that it is not practicable always to secure even water sterilized by boiling. Locke has suggested and reported favourably upon the use of a solution prepared according to the following formula:

℞ Calcium chloride ..... 3¾ grains;
Potassium chloride ..... 1½ grain;
Sodium chloride ..... 2½ drachms.
Sterilized, distilled, or tap water, sufficient to make one quart.

This solution is used either for hypodermoclysis, for enteroclysis, or for intravenous infusion. Schücking, of Pyrmont, acting upon the principle that paralysis of the heart after great loss of blood is always associated with, if not dependent upon, the accumulation of CO_2 in the tissues, sought some combination which would neutralize this gas. The task of eliminating the CO_2 under normal circumstances is allotted to paraglobulin, the alkaline compound proteid of the blood, and Schücking assumed that saccharate of sodium might take its place, inasmuch as this compound is split up by CO_2 into sugar and sodium carbonate, thus fixing the CO_2. He therefore employs the saccharate of sodium in the form of a 0.03-per-cent subcutaneous injection with 0.6 per cent of salt, and reports success with its use (250 grammes) after an alkaline salt solution had proved useless. The addition of albumen or serum or other organic elements to the fluid is both unnecessary and dangerous. *Transfusion of blood* from one person to another has become almost obsolete since the practical value of the normal salt solution has become understood.

Subcutaneous infusion of normal salt solution (hypodermoclysis) may be practised by inserting beneath the mammary gland, or deep into any area of loose cellular tissue, the sterilized needle of an aspirator, attached either to an ordinary Davidson's syringe or to a fountain syringe. Elaborate special apparatus for this purpose is totally unnecessary in the hands of an operator who is familiar with the technique of asepsis. From six to eight ounces of the solution should be gently and gradually injected. The tumour which rapidly develops by the accumulation of the fluid, should be subjected to gentle friction, which seems to facilitate the diffusion of the fluid. The infusion can be made under both breasts at the same time, or, for that matter, even into other areas. Care should be taken to avoid throwing a considerable volume of fluid immediately beneath the integument, or where the skin is not provided with an ample cushion of underlying cellular tissue, as the pressure that may otherwise be induced may cause superficial destruction of the skin.

Subcutaneous infusion is so readily practised and is so destitute of danger that it should be accepted as the operation of choice, as against intravenous injection, in all cases in which the shock is not

profound, or the hemorrhage has not been excessive, or in which delay of from fifteen to twenty minutes may be indulged before the fluid finds its way into the circulation.

Intravenous infusion of normal salt solution is practised by opening one of the superficial veins of the forearm. This is done by compressing the vein until it becomes distended with blood; a small incision is then made through the integument until the vein is reached. This is then picked up by means of a grooved director, and two ligatures, half an inch apart, are placed in position. The distal ligature is then tied; a small opening is made into the vein between the two ligatures; through this opening a small blunt-pointed trocar is introduced into the lumen of the vein to a point above the location of the proximal ligature, which is now tightened around both the trocar and the vein. Care should be taken before inserting the trocar to see that it is filled with water from the syringe or reservoir with which it is connected. After the trocar has been inserted into the vein and the ligature has been tightened around it, the fluid is permitted to flow into the vein. This fluid should not be permitted to fall to a temperature below 100° F., and it should be used from a graduate or some other reservoir by which its quantity may be determined. Not less than eight ounces should be inserted at one time in the case of shock, while a quantity equal to or slightly in excess of the amount of blood lost, should be injected in case of hemorrhage, but not until the bleeding vessel has been tied. (See Treatment of Hemorrhage.)

Rectal Infusion (*Enteroclysis*).—Cases may occur in which it is not convenient at the moment to practise either intravenous or subcutaneous infusion because of the absence of the necessary apparatus, while there are other cases in which the loss of blood has been so great, and the shock is so profound, that it is desirable to employ not only the foregoing expedients, but any auxiliary to them. Under these circumstances a considerable quantity of the normal salt solution, heated to 110° or 115° F., may be thrown into the rectum. More than six or eight ounces should not be employed, as overdistention of the bowel will defeat the purpose of the injection by causing a rejection of the fluid. If, however, it is desired to use a greater quantity, it should be given as a high enema. This is done by placing the patient upon the left side, with the legs flexed and the hips elevated, and permitting from a quart to a half gallon of the fluid gradually to enter the alimentary canal. This is not only an effective way of applying heat, but, by bringing the fluid in contact with the powerfully absorbent surfaces of the colon, the procedure becomes an effective way of reaching the circulation.

CHAPTER X

HEMORRHAGE AND HEMOSTASIS

Hemorrhage, obvious and concealed—Symptoms—Diagnosis—Treatment: Hemostasis, styptics, heat, pressure, angeiotripsy, electro-hemostasis, ligatures.

Hemorrhage may be studied under the head of (*a*) *obvious,* and (*b*) *concealed.* Obvious hemorrhage may be, in origin, both internal, as in metrorrhagia, and external, as in operations. Concealed hemorrhage, on the other hand, is always internal, as, for instance, in rupture of a tubal pregnancy or a slipped pedicle in ovariotomy.

Symptoms of Hemorrhage.—When hemorrhage is obvious—i. e., when there is an external flow, whatever may be the origin of the blood—the mere presence of the latter is all that is necessary for diagnosis, except, perhaps, in the instance of sanguineous discharges from the uterus. Under these circumstances it is sometimes important to discriminate between the menstrual flow and hemorrhage from other causes (see Menstruation). The question of internal hemorrhage, however, is one which demands solution in the light of symptoms other than an obvious discharge of blood. Hemorrhage rarely, if ever, occurs without occasioning discomfort, amounting in cases to acute pain in the locality in which it occurs. Pain is, therefore, to be regarded as the usual initial symptom, particularly in all cases of vascular rupture. There is generally so much pain present, following an intrapelvic operation, that the slipping of the pedicle, for example, would give rise to no conscious sensation, unless by the relief of the pressure there occurred some amelioration of the pre-existing discomfort. The pulse is accelerated from the first, but the acceleration increases coincidently with the duration of the hemorrhage. With the increased frequency of the heart beat there is a progressive diminution in the volume and tension of the pulse. The temperature speedily becomes subnormal. The respiration, at first but slightly disturbed, speedily becomes frequent and irregular, the patient sighing in her efforts to secure enough oxygen to neutralize the rapidly accumulating carbonic dioxide in her system. Irregular muscular activity is noted; the lips become livid and the finger nails blue; there is general pallor of the face and of the mucous surfaces; the skin becomes bathed in perspiration; strange sounds are heard and muttering delirium ensues, in the midst of which the patient's eyes become staring; the alæ of the nose become dilated; the

features become pinched, until collapse, unconsciousness, and death, close the scene.

Diagnosis of Hemorrhage.—(See Diagnosis of Shock.)

Treatment of Hemorrhage.—The treatment of hemorrhage, classified inversely to its importance, is both (*a*) constitutional, and (*b*) local. Constitutional measures must be addressed to the conservation of the remaining circulatory medium, to the relief of the practically always concomitant symptoms of shock, and finally to the speedy restoration of the volume of the blood. Practically all these measures are considered in detail under the head of Treatment of Shock, which should be read in this connection.

The local treatment should be based upon the general surgical axiom to "cut down and tie the bleeding vessel" in the presence of concealed hemorrhage of a degree sufficient to cause constitutional symptoms. The more profound the shock, the more imperative is this decree, the operation of which may in certain instances result in surgical intervention for the relief of hemorrhage capable of spontaneous arrest. This is exemplified in hemorrhages into the broad ligament, which, through the joint influence of the peritoneal investment and the formation of hemorrhagic infarcts, may come to a spontaneous termination, resulting ultimately in the absorption of the clot. These cases, which will be considered more in detail in connection with ectopic pregnancy, and which serve as the most favourable examples of concealed hemorrhage, are more safely treated, as a rule, by operation. In superficial hemorrhage, where the bleeding vessel is accessible, it should be brought under immediate control by some of the various expedients to be considered under the head of hemostasis.

Hemostasis.—Control of hemorrhage was one of the most perplexing problems in the early development of gynecologic surgery. The earlier mortality tables exhibit what to-day would be looked upon as an alarmingly high percentage of deaths from hemorrhage. The present resources, however, are so adequate, that a death from hemorrhage under ordinary circumstances places the surgeon upon the defensive. Hemostatic measures may be considered under the heads of (*a*) styptics, (*b*) heat, (*c*) pressure, (*d*) electro-hemostasis, (*e*) ligatures.

Styptics.—Styptics consist of those remedies which exercise an astringent effect upon the tissues to which they are applied. Practically all the mineral astringents possess more or less styptic properties. Sulphate of iron, sulphate of zinc, acetate of lead, and sulphate of copper, are examples in point. All vegetable preparations possessing styptic properties depend for their activity upon the presence of tannin. Extract of the suprarenal capsule applied to oozing surfaces exercises an instantaneous influence over capillary hemorrhage. Among the most valuable of styptics, and the more valuable because it is practically always at hand, is dilute acetic acid in the form of commercial vinegar, such as is found in almost every household. This may be applied pure, or in the form of a douche, one part of vinegar to four

parts of water, or gauze may be saturated with it and packed into a bleeding cavity. Any vessel, the hemorrhage from which occurs in the form of an intermittent jet, is too large to be intrusted safely to a styptic.

Heat.—Heat is a hemostatic of broad application in abdominal and pelvic surgery. Its use is based upon the fact that it has the effect of constricting the blood vessels subjected to its influence, or in higher degrees of temperature it may desiccate and even char the tissues. When heat is so great as to immediately destroy the continuity of structure, it does not control hemorrhage from vessels of larger calibre. In metrorrhagia, or in intrauterine oozing following operations within the cavity of the uterus, it is a valuable remedy when applied in the form of an *intrauterine douche.* To be effective, the temperature should be not less than 115° F., and the application should be continued for not less than fifteen minutes. *Hot sponge packing* is an exceedingly valuable expedient in controlling diffuse capillary oozing in intrapelvic and other operations. Sponges, or, for that matter, the gauze napkins now almost universally employed, should be wrung out of water at a temperature of not less than 120° F., and immediately placed in contact with the oozing surface. They should be left there for several minutes—long enough to secure the secondary effect of heat upon the capillaries. For this purpose sponges are better than the gauze, because they possess elastic properties, which increase the pressure, also a valuable element in the control of bleeding.

The *actual cautery* is one form of the application of heat for the control of hemorrhage. Irons variously shaped and fitted into handles are heated and applied to the bleeding surface. Keith caught the pedicle of a fibroid tumour in a nonconducting clamp, and then by means of hot irons heated to a red glow, and persistently applied for several minutes, reduced the stump to a state of complete desiccation, rendering the hemostasis absolute. *Paquelin's thermocautery* is merely a more convenient form of the old actual cautery. It consists of various shaped platinum tips, hollow, containing coils of platinum wire, and communicating with a reservoir containing benzole. Over this chamber of benzole a current of air is passed, creating a combustible vapour, which is burned in the hollow platinum point of the instrument. By regulating the pressure upon the bulb the heat can be correspondingly regulated. The instrument is vastly more convenient than the old irons, which have become practically obsolete.

Pressure.—Actual pressure may be exerted by the fingers or thumbs placed upon a bleeding vessel. *Elastic pressure* is practised by encircling a bleeding part with an elastic ligature, stretched to a degree of considerable tension, and secured either by a knot or catch forceps. These should be recognised merely as temporary expedients, as it is manifestly impossible to sustain the former for long, while the latter soon induces tissue necrosis from pressure. *Forcipressure* is practised by seizing the bleeding vessel with a forceps. This principle has been

recognised in surgery from antiquity, but it was left for Koeberlé and Péan to devise the useful instruments now known, respectively, by their names (see Armamentarium). It may be said without contradiction that the introduction of this instrument, for they are practically the same, has added vastly to the usefulness of surgery. It has been variously modified into long and short, thick and thin, straight and curved, light and heavy, but the principle involved is the same in all of them. The forceps consists, essentially, of two scissorlike blades, the distal extremities of which are arranged into serrated, approximating jaws, while the proximal ends are arranged with the usual scissor-handle rings and an intervening catch to admit of regulated pressure and fixation. The hemostatic forceps is usually applied for the immediate and temporary arrest of hemorrhage. In very small vessels, as, for instance, in the abdominal incision, the pressure thus exercised is sufficient permanently to control the bleeding; while in larger vessels a ligature should be applied before the forceps is removed. For this purpose a forceps of relatively thick jaws and tapering to a sharp point is desirable, as it permits the ligature to slide readily upon the vessel. In certain localities it is not practicable to apply a ligature to control the hemorrhage, under which circumstances the forceps is left *in situ* for a period of not less than twenty-four hours. It occasionally happens that the tissues in the field of operation are so friable that they will not resist the pressure of a ligature, when continuous pressure by the forceps becomes essential.

Angeiotripsy.—The angeiotribe, or pressure forceps, is an instrument designed to do away with the use of ligatures or retention forceps in removal of the uterus, and in extirpation of the tubes, ovaries, and tumours having suitable pedicles. It is founded upon the surgical principle of preventing hemorrhage by the formation and retention of blood clot. It may be used in both vaginal and abdominal section, but not upon omental and like fragile tissue. It is presented in many forms, all having the same mechanical purpose, but differing in the application of the force principle. The pressure is obtained by means of the accurate adjustment of blades to which a pressure of three thousand pounds is imparted by the mechanism of the handles. Tuffier employs screw pressure; Doyen and Thumin the lever; and there are other modifications of both these principles in use.

The cut (Fig. 27) shows the Newman angeiotribe furnished with both lever and screw as adjustable attachments, and designed for both vaginal and abdominal work. (See chapter on Panhysterectomy.) The method of its employment is illustrated in vaginal hysterectomy. The operator proceeds as usual until the uterus is freed from its anterior and posterior attachments, including all adhesions, and remains suspended only by the broad and round ligaments. The left broad ligament is now hooked down by means of the left index and middle fingers or a large blunt hook of the Eastman variety, and included in the bite of the angeiotribe. An assistant steadies the instrument while the

screw is adjusted to the requisite pressure and allowed to remain for one or two minutes. While the instrument is *in situ* the ligament is divided with scissors between clamp and uterus, leaving a margin of say a half centimetre of tissue, constituting a small, neat stump, of ribbonlike thinness. This dissection releases the uterus from its attachments upon the left side, and it is a simple matter to draw it down outside the vulva, so as to expose the right ligament. The clamp is now best applied from above downward, and the ligament is cut as on the opposite side.

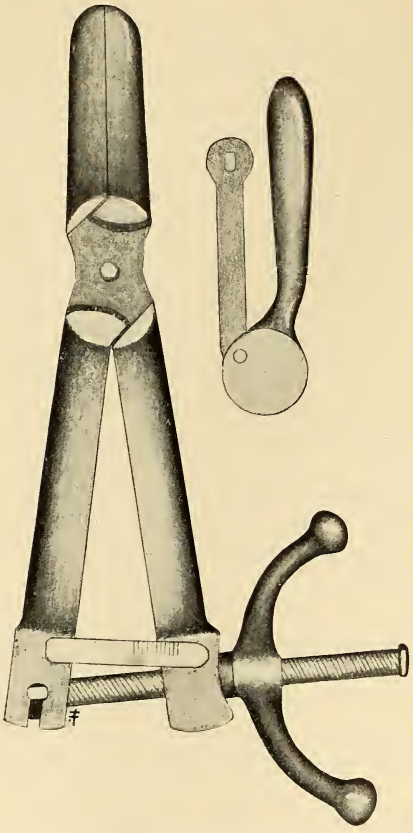

Fig. 27.—"The Newman angeiotribe furnished with lever and screw."—Newman (page 81).

When the instrument is released for the last time and removed, careful toilet and inspection of the entire field of operation are made, and the sterilized gauze packing used in the customary manner, or a running catgut suture, including peritoneal and vaginal surfaces, closes the vaginal vault, catching up the contracted stumps in each angle of the wound. The external dressings are applied as usual, but the after-treatment is greatly simplified, as there are no retention forceps to be watched and removed, and no ligatures to come away.

There is little or no pain, and the comfortable condition of the patient after recovery from anæsthesia is in marked contrast to sufferings of other patients under the retention clamp method.

When it is found difficult to secure the entire broad ligament at one application the angeiotribe may be applied twice upon each side, compressing first the lower half of the left ligament, including the uterine artery, then the same area upon the right side. With the lower half of the broad ligament cut free of the uterus, the upper half can usually be easily drawn down by the fingers or broad ligament hook, and the clamp applied upon its remaining portion containing the ovarian artery.

Another method, and one which Newman frequently uses, consists in applying temporarily to the base of the ligament the ordinary clamp

or ligature, cutting this portion, inverting the uterus forward out of the anterior peritoneal opening, and applying the angeiotribe on each side from above downward the entire width of the broad ligament, including the stump of the previously clamped or ligated base.

The *dry pack* is another means of applying pressure, especially within the peritoneal cavity, the cavity of the uterus, and the vagina. Within the peritoneal cavity, the method of Mikulicz, who introduced the practice, is as follows: The cavity is lined, preferably with a pocket formed of iodoform gauze. Into this pocket a rope of iodoform gauze is stuffed until the entire cavity is filled. It should be packed with sufficient firmness to insure pressure upon the proximal bleeding surface. This practice has been modified very generally by simply packing the bleeding cavity with a rope of sterilized gauze, without taking the precaution to line the cavity with a gauze pouch. Packing thus introduced should not be withdrawn under less than twenty-four hours; after this time, if the vessels are not very large, hemostasis is reasonably certain.

Electro-hemostasis.—Electro-hemostasis is in reality but another form of controlling hemorrhage by heat. In this instance the heat is generated by the electric current and is brought in contact with the tissues by means of the electric loop, the electric knife, the electric forceps, or by means of a platinum cautery tip. The same proportions should be observed in the application of electricity for hemostatic purposes that are prescribed for the use of heat in any other form applied to the control of hemorrhage. The most essential of these precautions are, first, to avoid the use of too high a degree of heat, and secondly, to protect adjacent structures from its action.

John Byrne, of Brooklyn, was the first to popularize the galvanocautery in America, and to him is due the credit of demonstrating its hemostatic possibilities in high amputation of the cervix for cancer. It can not be said, however, that this operation is the most crucial test to which a hemostatic measure can be subjected, for the reason that high amputation of the cervix can be practised as an almost bloodless operation, without the use of any hemostatic whatever. As used by Byrne, the instrument consists of a loop of platinum wire, passed through a noose carrier and both ends of it attached to a key, not unlike that of a violin, whereby the size and tension of the loop can be accurately regulated. Either end of the wire is brought into contact with the opposite poles of the battery, which may be either a storage battery or a primary battery, or the current may be taken from an electric-light circuit and utilized through the medium of a transformer. Further details of the use of the electric loop will be mentioned in connection with vaginal hysterectomy. The electric knife consists of a smaller loop of platinum wire, flattened and fixed in a nonconducting handle, through which it passes, and is attached to the battery. By means of the regulator this blade can be brought to any degree of temperature desired. When, however, it is utilized to pass through tissues, it must

be heated to so high a degree that its hemostatic properties are relatively diminished. When using either the electric loop or the electric knife, the handles, of whatever material constructed, should be wrapped with moist, sterilized flannel, to protect the vagina from the action of the heat.

Hemostasis by the use of the *electric forceps* is one of the most valuable of our recent additions to surgery, the credit for whose invention belongs to the late Dr. Skene, of Brooklyn. It is an adaptation of heat and pressure, in combination, to the control of hemorrhage. In its simplest form the apparatus consists of the electric forceps proper, conducting cables, and a storage battery (Fig. 28). Instead of the latter, the current may be taken from an electric-light plug and passed through a transformer, with which the forceps, in turn, is connected. If the electric-light current is continuous, a rotary converter will be required to convert it into an alternating current suitable for operating the transformer. The forceps may be of various forms and sizes. "One jaw of the forceps is hollow and is heated by having a resistance wire located at the bottom of the chamber close to the face of the jaw, from which it is insulated by a thin layer of fireproof material. The chamber above the wire is filled with insulating material, which is also a nonconductor of heat, such as asbestos, and is so closed by a sheet metal cover as to be watertight. One end of the resistance wire is connected to the jaw and the other to an insulated copper wire placed in a metal tube, which extends from the chamber along the shaft of the forceps handle to a metal block, which is attached near the ring end of the forceps handle. A copper wire is here connected to an insulated terminal mounted in the block. A similar terminal is attached directly to the block and is uninsulated. By this means of construction the electrical wires are incased in metal,

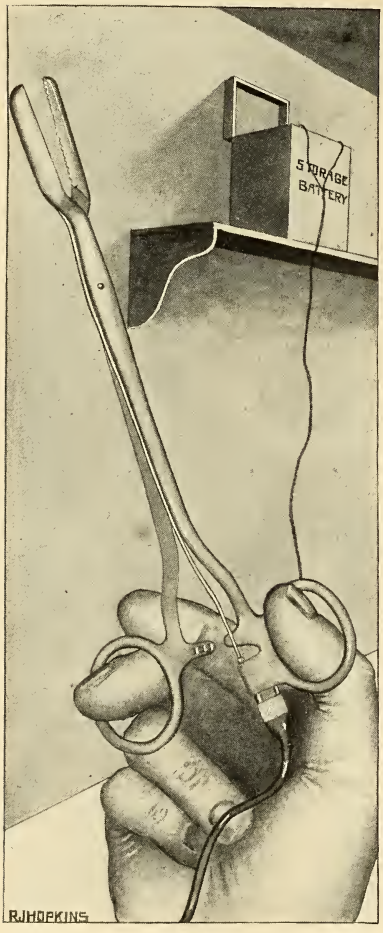

Fig. 28.—"The apparatus consists of the electric forceps proper, conducting cables, and a storage battery."—Reed.

so that the forceps can be sterilized and handled without injury, the same as any ordinary instrument. Starting at the insulated terminal, the path of the current is through the copper wire and the resistance wire to the tip of the jaw, thence through the blade of the forceps to the uninsulated terminal. The copper wire and the blade of the forceps form a path of good electrical conductivity, and are consequently but slightly heated by the passage of the current used. On the other hand, the wire in the chamber is a poor conductor and is heated to a greater or less degree, according to its resistance and the strength of the current."

Before applying the electric forceps it is sterilized, just as is any other instrument; but care should be taken after its removal from the sterilizer to avoid placing it immediately into cold water, as the contraction thereby induced may result in destroying the air-tight quality of the jaw containing the insulated terminals. The rubber-covered end of the electrical cable is best sterilized in boiling water, and should then be wrapped in a sterilized towel, or immersed in a five-per-cent carbolic solution. A little sterilized vaseline should be placed on the approximating surfaces of the jaws of the instrument to prevent the tissues from adhering to them.

The method of using the electric forceps consists in firmly compressing a portion of the bleeding tissue, or preferably the end of the bleeding vessel, between the jaws of the instrument, the object being to expel as much of the moisture as possible, before the electric current is turned on, an expedient which greatly facilitates the subsequent process of desiccation. The forceps is then subjected to the current, and by that means heated to a temperature of from 180° to 190° F., just enough to desiccate but not to char the tissues.

All tissues to be treated should be firmly compressed between the jaws of the instrument applied cold and subsequently heated. If this precaution is not observed, it will be necessary to reapply the instrument, and thus consume additional time. Skene advises that before the electric current is turned on a piece of gauze or a shield should be applied, where needed, between the forceps and the adjacent tissues, to protect them from injury by contact with the hot instrument. The forceps should be left on from thirty seconds to two minutes, according to the thickness of the tissues or the size of its contained vessels. Before it is removed the tissues projecting beyond its jaws are cut off, and the pedicle beneath is seized with a shield or compression forceps to hold the stump in position for inspection. The forceps is then gradually opened and the desiccated stump is permitted to slide out from between the jaws in the direction of the teeth. Skene insists upon this precaution as one of importance. The absence of bleeding upon the removal of the forceps indicates that the desiccation has been sufficiently effective, and Skene assures us the stump can be left without fear of secondary hemorrhage. If, however, bleeding should occur immediately upon the removal of the forceps, the latter should be reap-

plied at once, and the heating should be repeated with about ten per cent more current, or for a longer time. In this way the tissues will become thoroughly desiccated, but not charred, and the blood vessels so thoroughly occluded that they can not be opened up again, either by blood pressure or the most critical dissection.

Ligatures.—It is a suggestive fact that practically all accepted ligature materials are of animal origin. This remark is intended to apply to silk, which, being the product of the silkworm, is quite as much an animal as it is a vegetable product. *Silk* has been the material of preference for ligature purposes for many years. It has the advantages of being strong, very flexible, capable of being tied in a firm knot, and within the peritoneal cavity it is capable of absorption by the tissues. On the other hand, there is much difficulty in securing a pure article, and its adulteration with either cotton or flax renders it incapable of absorption when used in intrapelvic work. It is as difficult of sterilization as is catgut or any other of the distinctly recognised animal ligature materials. It will not become absorbed when used as a buried suture in the parietal tissues, and in the presence of infection it becomes the nidus for the development of secondary abscesses, sinuses, etc. If silk is used, care should be taken to ascertain that it is pure. This can be done by dropping a piece of the thread into liquor potassæ; if in the course of twelve hours it thoroughly dissolves, it may be accepted as pure; if shreds remain, the fact may be accepted as evidence that it is adulterated with either cotton or linen, and should be discarded. In its preparation for use it should be sterilized by boiling at a high degree from fifteen to twenty minutes, or subjected to steam pressure of not less than forty-five pounds to the square inch during a similar period, after which, for further protection, it should be kept in a solution of absolute alcohol containing not less than two per cent of carbolic acid. It can be prepared in different sizes and should be kept in hermetically sealed jars, through an elastic covering of which it can be drawn as needed. It should be remembered that silk kept in a state of moisture for any considerable length of time will disintegrate to a degree that renders it unfit for use. Catgut is a ligature material of great popularity, for the proper preparation of which see Antisepsis.

CHAPTER XI

ANÆSTHETICS AND ANÆSTHESIA IN GYNECOLOGY

Definitions—Anæsthetic agents—Relative safety of ether and chloroform—Race and temperament in the selection of an anæsthetic—Indications and contra-indications for the use of ether and chloroform—Ether in relation to bodily temperature—Choice of anæsthetic for children—Bromide of ethyl, indications and contraindications—Administration of ether—Of mixed vapours—Of chloroform—Of bromide of ethyl—Management of respiratory and other accidents—Anæsthetic mixtures—Central anæsthesia by cocaine—General anæsthesia by alcohol—By hypnosis—Local anæsthesia.

Anæsthesia is a term suggested by Oliver Wendell Holmes as a proper one for the condition produced by the inhalation of sulphuric ether, and it has been universally adopted in all countries and languages and extended in its application, very properly, to all forms of loss of pain sense, whatever be the agent or cause producing this condition. It is natural, therefore, that all drugs capable of benumbing the sense of pain should be called anæsthetics. As a matter of fact, a very large number of substances are capable of producing this condition of anæsthesia, either when inhaled, when taken by other means into the body, or when acting locally on peripheral nerves; yet a great majority of these possess other powers which prevent us from using them—that is, they are lethal if not used very carefully, or irritant, or cause degenerative changes in the tissues. Although more than fifty years have elapsed since ether and chloroform were first employed as anæsthetics, no other drugs have yet been discovered which even remotely approach them in general usefulness, notwithstanding the fact that both these substances possess very great disadvantages. As a matter of fact, they are the only two drugs generally used in surgery to-day as anæsthetics for major operations. It is true that nitrous-oxide gas is largely used by dentists, but the physician and surgeon practically never use it because it is too fleeting in its effects, and because the apparatus for storing it is costly and cumbersome.

Anæsthetic Agents.—So far as the surgeon is concerned, the anæsthetic drugs which can be satisfactorily employed are ether, chloroform, and bromide of ethyl, named in the order of their popularity and safety. While it is true that in certain parts of this country and elsewhere chloroform is used to the exclusion of ether, it is also a fact that, taking the world at large, ether is most widely employed. It is a note-

worthy fact that in England and on the continent, where for many years chloroform was the favourite anæsthetic, ether is rapidly growing in popularity and in the frequency of its use. Bromide of ethyl is so little used in comparison with these two drugs that it can scarcely be mentioned with them, but as it is the only one of any real value besides the more important ones, it is named at this point.

Relative Safety of Ether and Chloroform.—The bald statement can be made without danger of correction that, as a rule, ether is by far the safer anæsthetic of the two for the average case. Statistics which are stupendous emphasize this fact, and it is as certain as anything human can be; but to make this statement without the additional fact that circumstances alter cases, that idiosyncrasy or disease may render it safer to use chloroform than ether, would be unjust to an important subject. That such conditions may, and in abdominal and pelvic surgery, especially, do exist and reverse the general rule just laid down, is as certain as that general rule itself.

Race and Temperament in the Selection of an Anæsthetic.—Upon the Anglo-Saxon race and those races who by close association, habit, and environment, are similarly affected by climate and other causes, ether, as a rule, acts well, provided that it is employed properly and that the temperature of the atmosphere is moderately cool. The presence of a high temperature, such as is met with in hot countries, renders it impossible to use ether with advantage, and makes it necessary to use chloroform. Again, it would seem that chloroform acts better upon southern peoples than upon northerners, and these facts point an explanation for the strenuous assertions of the ether advocate and the equally forcible statements of the employer of chloroform. Dogmatic statements upon both sides of this question have done an immense amount of harm. They have clouded the judgment of the profession, they have given medical students a bent which, once attained, has persisted all their lives, and finally they have led to most important legal complications. Hare has heard a great teacher tell his students that if they used chloroform, and had a death under its use, he would testify that the death was avoidable; and he is continually meeting men so influenced by those teachings of years ago that they do not use chloroform to-day because they are so fearful of an accident. This is not good doctrine. Every one who uses anæsthetics should employ them according to the case to be treated, and the employment of either drug to the exclusion of the other is not giving the patient or the physician himself all the chance for good results that is due to them. Yet at the present time these drugs are used by habit or routine to an extent that is unwise. There are as many reasons for using a given anæsthetic as a given drug in place of another, for there are indications and contraindications governing the use in either case.

Indications and Contraindications for the Use of Ether and Chloroform.—Beginning, then, with a consideration of the most important drug—ether—and believing that it is the anæsthetic best suited to a

majority of cases, what are the factors which render its use inadvisable in a given case? In the first place, its local effect upon the upper and lower respiratory tract is a distinct disadvantage in all cases, and the presence of a pre-existing irritation in these parts renders it very often a dangerous anæsthetic. To it are credited the production of severe attacks of bronchitis, pneumonia, and pulmonary œdema, and it is undoubtedly responsible for these sequelæ in some instances. The question is, How often is the irritation of the ether inhalation the real factor in the production of these states? Hare believes it to be very rarely so, except in susceptible children and old people, and in persons who have an idiosyncrasy to its use. In a large number of the cases the respiratory difficulties after etherization are due to exposure to cold, and very slightly, if at all, to the ether. This is a fact overlooked to an extent which is almost criminal in its negligence. There is not a reader of this chapter who has not seen patients stripped of nearly all covering but a sheet or shirt, and exposed for a long period, while some great heat citadel of the body, such as the abdominal cavity, is exposed or even opened to the general air of the room. Not one of them but knows that the abdominal wall is the first to feel exposure, and that the great vessels and abdominal organs are the heat distributors and centres of heat in the body; and yet even in the best operating rooms, the abdominal cavity, the natural temperature of which is about 103° F., is exposed to an atmosphere, warmed, it is true, but even when at 90° F., still thirteen degrees colder than the belly contents. Further, the lumbar region, the back and the buttocks, are often lying in a puddle of liquid for many minutes. There are few surgeons who could themselves survive such exposure without ill effect. It is true that ether helps the temperature to fall by its evaporation and its consequent abstraction of heat, by aiding the dissipation of heat by its effect on the vessels, and by affecting the nervous mechanism of heat regulation, but these other factors aid it also. Many years ago Hare reported a series of observations upon this subject, which showed that these assertions are true.

Ether in its Relation to Bodily Temperature.—In the lower animals a fall of temperature under profound etherization may amount to as many as 8° to 10° F., and in man it is by no means uncommon to observe a fall of as much as three degrees below normal, the fall being influenced somewhat by the part of the body operated upon. In thirteen cases taken at random the greatest fall was 4.4° and the lowest 1.2° F. There can be no doubt that much of the renal congestion and respiratory disorder met with after operations would be set aside if the patient was supplied with heat during the use of the anæsthetic, rather than after he is put back to bed.

Without any desire to defend ether from the assertion that its respiratory effects are somewhat baneful, let us then be sure that it is at fault in a given case before discrediting its claim to usefulness.

Again, ether is often given in a manner which is improper in more

ways than one. Partly because the youthful assistant who gives the anæsthetic is desirous of being quick in his work, partly because his superior is often urging him to hurry the patient into the operating room, the drug is poured too freely upon the inhaler and the inhaler held too closely to the patient's face, with the result that the ether vapour comes in concentrated form upon mucous membranes not prepared to receive it, which causes a profuse outpouring (*Therapeutic Gazette*, 1888, p. 317) of secretion, accompanied with struggling and cyanosis. Any assistant whose patient struggles in the first stage of the anæsthetizing process is not performing his function properly. The early stage should be sufficiently prolonged to produce quietly the so-called primary anæsthesia, and the inhaler should be gradually brought nearer and nearer to the patient as the effect of the drug is momentarily increased. By this means evil dreams or delusions in the later stages are often avoided. If a patient sinks into unconsciousness under the firm mental impression that she is being choked to death, the dreams that follow are not apt to be joyful. Aside from the troublesome struggling later on in anæsthesia, it should be recalled that the nervous shock of such a sensation and such dreaming is a severe strain upon the patient's nervous system. An ordinary nightmare is sufficiently disturbing, but a real operation added to it, preceded by a conscious period of fright, is a terrible combination of nerve-straining elements. It is for this reason in part that physicians are continually seeing patients who, having left the surgeon's hands as "operative recoveries," are physical wrecks.

Even if ether is given properly it may produce evil effects, as already stated, and in general terms it may be considered that known idiosyncrasies to its effects from former accidents or sequelæ, acute and chronic bronchitis, nephritis in all its forms, but particularly in its acute and parenchymatous forms, and laryngeal inflammations, render chloroform the preferable drug. In all cases in which the surgeon has control of his patients for any length of time before the operation a careful examination of the urine should be made. Not only should albumin and cysts be sought for, but several estimations of the amount of urea excreted in twenty-four hours should be made, since this will oftentimes reveal renal inadequacy or diseases which may be exaggerated by the anæsthetic and cause complications which are undesirable and dangerous.

Again, in the presence of marked atheromatous degenerations of the arteries, of aneurism, and abdominal inflammation, chloroform is the better anæsthetic, since it lowers rather than raises blood pressure and does not cause struggling, as does ether, and, therefore, is not so apt to cause apoplexy, nor is vomiting so apt to follow its use.

On the other hand, if any dilatation of the heart or degeneration of its walls and severe valvular leakage is present, then ether is the safer drug.

There are operative reasons for choosing one anæsthetic in prefer-

ence to the other which are almost as important as those just given. Other things being equal, and the anæsthetizer being skilled in the use of chloroform, this drug is often superior to ether in that it does not so frequently cause vomiting, which, if severe, may be disadvantageous in abdominal operations. It must be borne in mind, however, that if proper ante-operative procedures are taken and ether is given with care and with *oxygen*, vomiting can often be entirely avoided, and *ether is the drug of preference in the majority of cases in cool climates.*

Choice of Anæsthetic for Children.—There can be no doubt that in very young children ether may cause considerable bronchitis, sometimes associated with such an outpouring of mucous liquid that a state approaching suffocative catarrh is developed. Chloroform, if properly given, does not do this. Not only is this true, but it is also a fact that very young children have a certain amount of immunity from the lethal effects of chloroform. There are few instances on record of death from chloroform in young children, and this fact, combined with the avoidance of respiratory irritation and the early struggling produced by ether, renders it wise in many instances to employ chloroform.

Bromide of Ethyl—Indications and Contraindications.—The question may well be asked, Under what circumstances is it proper to use bromide of ethyl? Before answering this question, it must be recalled that this drug is even yet under a cloud, and has not reached a degree of popular favour which makes the uninitiated feel like trying it. This state of affairs depends upon several factors. In the first place, the early attempts made to introduce it into practice in this country were productive of catastrophes which frightened the surgeons using it sufficiently to make them give up its employment, and incidentally alarmed those who had not yet attempted its use. The use of a new and untried drug followed by an accident would naturally impose upon the medical man an increased load of blame, yet the occurrence by coincidence of such accidents when the drug was first used, is no reason for condemning the drug as too unsafe to warrant its administration. The very fact that the anæsthetizer did not know how best to give it rendered it more likely to act badly than when it was skilfully used, and in all probability the preparation of the drug employed may not have been pure. The writer has often wondered how long the use of ether or chloroform might have been delayed had the first patients placed under their influence died, a possibility by no means remote, because those patients might perchance have had hearts unfit for the use of those drugs. If, for example, Sir James Simpson's " chloroform party " had ended in a chloroform catastrophe, one or more of them never coming back to life, what an unjust blow would have been given to a most useful drug, and who would have felt like repeating the test!

As a matter of fact, a certain number of deaths have been recorded as having been caused by bromide of ethyl (see page 95 for possible causes), and there can be no doubt that it is capable of causing death if badly given to a patient unfit for its use. The important questions

are, whether it is safe enough to justify its common use, and whether it fulfils any indications not so well filled by ether and chloroform. The answer to both these questions is in the affirmative. The drug has been given many thousand times without ill effects and deserves a place in the hands of the gynecological operator and obstetrician. Certain perfectly proper and easily taken precautions are essential for its satisfactory use (see page 95). The indications for its employment are sufficient and numerous. The first of these is met with when we desire to employ a rapidly acting, agreeable, and fleeting anæsthetic for the performance of short operations, such as curetting and dilating the uterus, and in making painful examinations. When properly given, bromide of ethyl produces anæsthesia almost as rapidly as nitrous oxide, and when it is stopped the patient returns to consciousness almost as speedily as when the gas is given, and without any nausea, vomiting, dizziness, or other ill effects. It lends itself, therefore, to a large number of cases in and out of the gynecologist's office, and deserves greater use. There are two disadvantages connected with its employment—first, that there may be muscular tonic contraction or rigidity, which is annoying, and may render efforts at examination or operation difficult until it is overcome; and, secondly, that it is apt to leave a garlicky odour on the breath—two objections of comparatively small moment, after all. The drug is not suitable for prolonged operations.

The Administration of Ether.—The anæsthetizer, like the operator, knows that the simpler the instrument the easier the performance of the duty before him, and as a result there are but two forms of ether inhalers commonly employed in the United States, and these meet the needs of the case so well that nothing else need be considered. The one is the folded towel, turned into a well-made cone, stiffened, it may be, with a sheet of heavy paper or cardboard between its folds, and fitted in the apex with a small, clean, and sterile sponge or piece of absorbent cotton, to hold the anæsthetic fluid. For this may be substituted the Allis inhaler, which is a cylindrical or ovoid cover around a grated case, from the gratings of which layers of cotton cloth pass from side to side (Fig. 29). The air passes freely between the layers of cloth, which, being wet with ether, load the inspired air with anæsthetic vapour. If made of metal, so that it can be boiled after

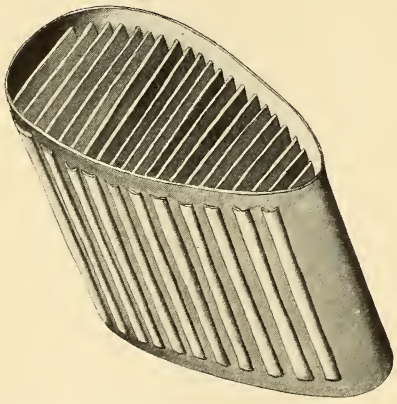

Fig. 29.—"The Allis inhaler, which is a cylindrical or ovoid cover around a grated case, from the gratings of which layers of cloth pass from side to side."—Hare.

each use, and kept rigidly clean, this is the best inhaler on the market, because it gives plenty of ether and it permits a view of the face of the patient. Both the simple cone and the Allis inhaler can be employed when it is desired to give oxygen gas with the anæsthetic, since the gas can be delivered to the patient by means of a soft tube slipped under the edge of the cone close to the patient's nose.

The Administration of Mixed Vapours for Anæsthetic Purposes.—There are several somewhat complex forms of apparatus on the market for giving ether and oxygen gas or chloroform and oxygen gas. Hare considers none satisfactory in every respect. In all forms which he has seen, the oxygen is made to bubble through the ether or the chloroform, thereby vaporizing the anæsthetic, and a mixture of oxygen gas and of the anæsthetic vapour is then conveyed through a tube to the inhaler, which is placed over the patient's nose and mouth. There are several disadvantages inseparable from this method of using this valuable combination of therapeutic agents. The first objection is that it is impossible to increase or decrease the quantity of oxygen gas supplied to the patient without at the same time increasing or decreasing the quantity of ether or chloroform, and conversely the quantity of these agents can not be verified without the supply of oxygen. Manifestly, an inability to make suitable variations in the quantity of these various agents is distinctly disadvantageous. As an illustration of how disadvantageous it may be, Hare mentions the fact that an eminent surgeon complained to him that a grave difficulty in the use of oxygen and ether lay in the long period of time required to get the patient under the anæsthetic. The cause of this delay was without doubt due to the fact that if large quantities of oxygen were passed through the ether with the purpose of conveying considerable amounts of the anæsthetic to the patients, the individual also received such large quantities of oxygen that a condition of physiologic apnœa, or shallow or arrested breathing, occurred through sedation of the respiratory centres. As soon as this sedation took place the patient breathed less deeply than before, or she stopped breathing entirely, and under these circumstances took but little anæsthetic vapour into the lungs, and so passed very slowly, if at all, under its influence. In Hare's opinion, therefore, the proper way to use oxygen by inhalation, in conjunction with the anæsthetic, is to place the drum upon whatever form of inhaler the physician desires to employ, and to carry into the inhaler the oxygen gas direct from the bag, which is usually attached to the steel cylinder containing the gas. Under these circumstances the patient receives both the anæsthetic and the oxygen, each of which can be increased in quantity, according to his needs, with the result that he can be speedily anæsthetized and yet receive all the oxygen that is necessary to prevent any of the disagreeable symptoms of anæsthetization and its disagreeable sequelæ. Such a plan has the added advantage that it is simple and does not require any additional apparatus, the rubber tube from the oxygen cylinder passing under the edge of the inhaler placed

upon the patient's face, and the supply of gas being governed by the stopcock on the cylinder.

One of the forms of apparatus which is usually sold for the simultaneous administration of oxygen and ether consists in an inhaler which covers the patient's nose and mouth and prevents him from getting any atmospheric air, with the result that he is forced to breathe nothing but pure oxygen, mixed with anæsthetic vapour. In order to make this still more complete, a large rubber bag is attached to the inhaler, which has no connection with the outside air, and which is inflated with each expiration of the patient and dilated with each inspiration. After a very few respiratory movements the patient is therefore receiving a mixture of oxygen anæsthetic and devitalized air, the quantity of the latter increasing with each subsequent respiration. Manifestly this method has two grave objections: First, that the patient is supplied with pure oxygen instead of with atmospheric air, whereas Nature provides healthy human beings with a mixture of oxygen and nitrogen. The other disadvantage is that the patient is continually taking back into his lungs impurities which he ought to be getting rid of.

That the administration of oxygen gas with ether or chloroform is a distinctly advantageous procedure can not be doubted. The pulse under both anæsthetics when the gas is given remains in good condition in a majority of cases, and there are no complications or sequelæ in the shape of depressions, nausea, or vomiting. Feeble circulation and respiratory disorders are much less frequently met with if oxygen is given than if it is not administered. Further than this, the progress of the patient during the anæsthetic period is usually peaceable, cyanosis being largely avoided.

The Administration of Chloroform.—For the administration of chloroform even more apparatus has been invented than for the giving of ether. Much of it is extremely complicated, possessing this disadvantage in addition to others which need not be considered in the brief space devoted to this article. While it is true that many of the English anæsthetizers employ these, American physicians are usually content with much simpler apparatus. There are, practically speaking, only two chloroform inhalers that can be generally employed with advantage—namely, that of Esmarch and that of Lawrie. Both of these inhalers embody two essentials of every form of apparatus used for the giving of chloroform—namely, the free access of air to the patient. All the more complicated inhalers are lacking in this important characteristic, or depend upon valves which may get out of order. The majority of anæsthetizers in this country employ a folded napkin or one of the inhalers just named. The patient should get at least ninety per cent of air during the use of the chloroform. Great advantages in the Esmarch and Lawrie inhalers are the facts that a free supply of air is present; too much of the drug can not be poured upon the inhaler without escaping, so that the patient can not receive an overdose, except

through gross negligence; and the face of the patient is readily seen. Whatever the form of inhaler used, it must never be held so tightly over the patient's face that air is cut off (Fig. 30).

The Lawrie inhaler is so cheap that a new one can be used for each patient, and the thin flannel cover of the Esmarch can be boiled each time it is used, thereby insuring sterilization.

When chloroform is given it must be placed on the inhaler in drops, and not poured on freely as one uses ether.

Finally, the anæsthetizer should remember that the dose of the anæsthetic is not that which he pours on the inhaler so much as the amount that the patient takes into his lungs, and, therefore, that in all cases the attention of the anæsthetizer should be centred on the respiration, for upon the rapidity and depth of this function does the dose depend. Again, as the respiratory function is the first one to feel the depressing effects of the drug, it acts as a good index of the degree of influence. In a case where the heart is known to be diseased, this organ must, of course, be watched also. Should the respiratory action become irregular or stormy, the anæsthetizer should at once stop the anæsthetic, since the irregularity indicates abnormal action of the drug, and the amount inhaled can not be estimated.

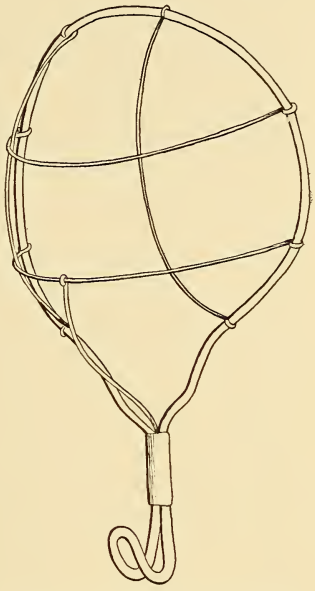

Fig. 30.—Esmarch's chloroform inhaler.—Hare.

The Administration of Bromide of Ethyl.—When bromide of ethyl is given, it should be placed upon a cone or inhaler which tightly fits the face, and be pushed freely until the patient passes under its effect, which will be rapidly accomplished, as a rule. Care must be taken that the bromide of ethylene is not used by mistake, and that the drug is kept in dark glass bottles to prevent its decomposition. In order to be sure of its purity, it is best to use the drug from hermetically sealed flasks.

Management of Respiratory and Other Accidents in Anæsthesia.—Attention may be called to the use of two instruments commonly employed by inexperienced anæsthetizers, which are nearly always, abused, viz., the mouth gag and tongue forceps. The mouth gag aids, rather than prevents, the falling of the tongue back into the mouth, and increases the possibility of the inhalation of saliva or other materials into the lungs; and the tongue forceps is almost invariably so constructed that it bruises, punches, or punctures, the tongue in a manner that is anything but wise. Inexperienced anæsthetizers are very apt

to believe that these two instruments should always be in their pocket, and should be frequently employed. As a matter of fact, they are very rarely, if ever, needed, and the proper manipulation of the head and jaw, and grasping the tip of the tongue with the fingers which have been covered with a towel, are quite sufficient to produce the proper position of this organ.

There is a common error in the method of manipulating the head and jaw in respiratory accidents under anæsthetics. Under such circumstances it is the custom to allow the patient's head to fall backward, so that the muscles in the anterior portion of the neck are in a condition of great extension, and it is thought that by maintaining this posture the glottis is widely opened so that air can readily pass in and out of the lungs. It is true that this position of the head does widely open the glottis, but at the same time it drops the soft palate down upon the dorsum of the tongue in such a way that the patient is required to take all the air that he needs through his nasal chambers. These upper air-passages are nearly always obstructed by mucus, which has been brought out as a result of the local irritation produced by the anæsthetic vapour. In addition, the nasal passages of many patients are partially or totally occluded by overgrowth of the mucous membrane covering the turbinated bones or by the presence of polypi, so that if any of these causes of obstruction are present it is most difficult for the patient to get air. If, on the other hand, the anæsthetizer, standing at the patient's head in his usual position, places a hand upon each side of the head and jaw in such a way that the palm of the hand covers each ear and the tip of the middle finger rests under the angle of the jaw, and then draws the head toward him, stretching the neck of the patient, and at the same time carries the head forward instead of backward, the result is that the glottis is quite as widely opened as when the head is extended upon the neck and carried backward, with the additional advantage that the soft palate is not strapped over the dorsum of the tongue, and the patient can, therefore, obtain air both through his mouth and nasal chambers. The attitude of the head under these circumstances in relation to the rest of the body, save for the fact that the patient is prone rather than erect, is that which is taken by the athlete when running. Surely no runner desiring to fill his lungs with air would tip his head far back with his chin pointed upward, but, on the other hand, would project his head forward in such a way as to make his upper passages as patulous as possible.

Anæsthetic Mixtures.—There are three anæsthetic mixtures to which reference should be made before leaving this subject. One of these is the so-called A.-C.-E. mixture, which contains alcohol, chloroform, and ether, this combination being made with the idea of securing the anæsthetic effect by three drugs; and of combating by the alcohol and ether any tendency to cardiac depression produced by the chloroform. Theoretically this mixture has something to recommend it, but practically the rapidity of vaporization of these three drugs is so dif-

ferent that the patient will get first one anæsthetic and then the other, and finally the alcohol, so that in reality he does not pass under the influence of all three at once. It can not be urged that there are serious objections to this mixture, but, on the other hand, there are no material advantages in it. The same objection holds against the C.-E. mixture, which contains chloroform and ether alone.

The last anæsthetic mixture which need be mentioned is Schleich's, which is made according to three formulas, differing, not in ingredients, but in the quantity of each ingredient, and which consists in a mixture of ether, chloroform, and petroleum ether. It is claimed by Schleich that the petroleum ether has no deleterious effects. He believes that the effect of chloroform and sulphuric ether, together with the addition of petroleum ether, prevents the disagreeable effects which are met with when chloroform or ether is given alone. While this mixture on its first appearance received considerable attention, increasing clinical experience has not been favourable to its employment, and it is speedily dropping out of use even in the hands of those who first considered it of great value.

Central Anæsthesia by Cocaine.—In 1885 spinal anæsthesia was practised by J. Leonard Corning, of New York. Tuffier utilizes it in the following way: A 2-per-cent solution of cocaine is sterilized by heating at 80° C., the sterilization being repeated each day for three consecutive days. This solution is thrown into the arachnoid space of the spinal cord by means of a sterilized hypodermic syringe with a long and heavy needle. To administer the injection a line is drawn from the crest of one ilium to the other. The forefinger of the left hand is placed on the spine of the vertebra immediately above the line just indicated. The detached needle of the hypodermic syringe is now inserted to the right and a little above the tip of the left forefinger, being pushed well into the spinal canal. The escape of the arachnoid fluid will indicate that the needle has entered the canal. The loaded barrel of the syringe is now attached to the needle through which the solution of cocaine is discharged slowly and without force. From 1.5 to 2 cubic centimetres of the fluid are used, the dose depending somewhat upon the size of the patient. Anæsthesia from the diaphragm to the toes will develop in from ten to twelve minutes; and the insensibility thus induced will last from one to three hours. The cardiac disturbance induced by this form of anæsthesia is less than that from either ether or chloroform. No fatalities have been accredited to it. A. Palmer Dudley and other American surgeons have utilized this form of central anæsthesia with success in hysterectomy and other equally severe operations. It is especially eligible in kidney complications.

General Anæsthesia by Alcohol.—It is practicable to bring patients into a condition of surgical anæsthesia by the administration of alcohol. J. M. Matthews, of Louisville, frequently operates painlessly for hemorrhoids and other rectal conditions in patients who are thus "dead drunk." The alcohol should be given in doses of an ounce

every few minutes until alcoholic coma is induced. It is an eligible expedient in alcoholic habitués, but is liable to induce an aggravating acute gastritis with attendant vomiting in patients who are not drinkers.

General Anæsthesia by Hypnosis.—The researches of Charcot, and later of the Medical School of Nancy, have established the possibility of entirely destroying physical sensibility by suggestion. Reed has operated for the repair of lacerated perineum, and for pelvic abscess by vaginal drainage, in patients who had been rendered unconscious by hypnotic anæsthesia. This, however, is not to be looked upon as an agent or influence of general utility, for the reason that women are not all subjective, and for the further reason that, notwithstanding there are no reflex manifestations of pain, nor any memory of the operation, it still seems that the impression registered upon the secondary or induced consciousness provokes shock to a degree that is not realized under general anæsthesia as ordinarily practised. The subject is one pregnant with great possibilities, and should be subjected to more critical study than has yet been accorded it by the English-speaking medical profession.

Local Anæsthesia.—It is sometimes desirable and even imperative to avoid the administration of general anæsthetics. Pain may be relieved under such circumstances by benumbing the parts with cold or with ether, or by using a subcutaneous injection of a 2-per-cent solution of cocaine. The latter remedy, however, should not be looked upon as innocuous, so far as its constitutional effects are concerned, serious cardiac and respiratory complications having ensued upon the administration of but a small quantity.

CHAPTER XII

ABDOMINAL SECTION

Terminology—Preliminary treatment of the patient—The evil of hypercatharsis—Examination of the urine—Instruments—Preparation of the field of operation—Location of the incision—Direction and varieties of the incision: Vertical median, transverse umbilical, transverse suprapubic, oblique ventral, inguinal, oblique subcostal, lumbo-iliac, lumbo-costal—General observations on making the incision—Closure—Immediate and complete by laminated suture—Where drainage is necessary by suture *en masse*—Drainage.

There has been much discussion of the various terms which, from time to time, have been coined to designate the operation whereby the abdominal cavity is opened and its viscera made accessible for surgical purposes. Blancard, of Middleburg, Zealand, published a work nearly two hundred years ago in which he employed the word "gastrotomia" to designate "the cutting open of the abdomen and womb, as in *sectio Cæsarea*." The word comes from two Greek terms—namely, γαστήρ, meaning belly or stomach, and τομή, meaning incision. The first of these terms was formerly employed in its ordinary and vulgar sense of belly. Since operations upon the stomach proper have come into vogue, the term has been narrowed in its significance, and is commonly used exclusively to designate the operation of making fistulæ into that organ.

Laparotomy (derived from λαπάρα, the flanks, and τομή [τέμνειν, to cut]; French, *laparotomie*; German, *Laparotomie*) was, perhaps, the next coinage, and had, originally, a meaning that was entirely consistent with its purpose. It was employed early in the nineteenth century to designate the operations in the inguinal regions, as, for instance, for hernia and colotomy. In later years, however, with the advent of what has since become known as abdominal surgery, "laparotomy" was made to mean all operations upon the abdominal wall. This was such a manifest misapplication of the original meaning of the term that the profession has largely abandoned its use. The first revolt was emphasized by Lawson Tait, who employed in its stead the expression "abdominal section." This term, in turn, has occasioned considerable discussion. Greig Smith says that it is, perhaps, "most objectionable of all; an abdominal section," he adds, "is made

L. of C.

on a frozen cadaver with a saw for anatomical purposes; it is not easy to understand how an evil chance led to the name being given to an incision made through part of the abdominal wall for surgical purposes."

This criticism must be recognised as of doubtful accuracy. The word "section" is derived from the Latin *sectio*, meaning simply "to cut." A statement that "section" must imply amputation or an absolute severance of one part from the other, is, therefore, an unjustifiable stricture. The fact remains that, by convention at least, it has come to be synonymous with incision. This has been verified through generations, and for that matter centuries, in the term Cæsarean section. Latterly we hear of *perineal section*, *sagittal section*, and many other equally legitimate applications of the word. The word *cœliotomy*—from the Greek κοιλία, the belly, and τέμνειν, to cut, and corresponding in significance with the French *cœliotomie*, the German *koilotomie* and *bauchschnitt*—does not materially help the situation. The word cœliotomy was brought to the attention of the profession by the late Dr. R. P. Harris, of Philadelphia, although Dr. F. P. Foster, writing on the subject, says "this term seems to have been introduced by Davies-Colley." "Some good people," continues Foster, "write it celiotomy; many consider it more expressive than laparotomy, but with its adoption has sprung up the curious term 'abdominal cœliotomy,' an abdominal opening of the abdomen, as distinguished from vaginal cœliotomy. The term abdominal section answers every purpose, and seems to me preferable to both cœliotomy and laparotomy."

The Preliminary Treatment of the Patient.—In the absence of an emergency, such as hemorrhage, acute sepsis, or strangulation, time should be taken to prepare the patient's system for the operation. This should be done by giving particular attention to the state of the secretions. Most patients, particularly those of the more chronic class, are constipated, and their systems are, as a consequence, laden with toxines from the hyperabsorption constantly going on from the alimentary canal. The condition is all the more serious because of the defective peristalsis which is liable to be still further weakened, if not entirely arrested, by the influence of the operation upon the sympathetic nervous system. It is highly important, therefore, for these two reasons, if for no other, that the bowels should be not only unloaded, but brought to an approximately normal standard of activity. This is best done by giving the patient a small dose (one sixtieth of a grain) of strychnine with salol (three grains) three times daily associated with a persistent course of salines. For the latter purpose the magnesium sulphate, the sodium sulphate, or the sodium phosphate, may be employed, either in the form of some of the natural mineral waters, or by dissolving some of the salt in plain water. More important, perhaps, than the selection of the remedy is the manner of its administration. The best results are obtained by giving drachm

doses, beginning, not before, but after a meal. If the chosen remedy is continued in this way during twenty-four hours and no laxative effect is realized, it may be well to unload the bowels of their now softened contents by administering one full dose of the medicament, given this time on an empty stomach. The saline should not be discontinued so soon as the bowels have been evacuated, although a little time should be given for the previously secured laxative effect to subside. The saline should then be resumed in half doses, given an hour or two after each meal. In this way it becomes mixed with the ingesta, and, by stimulating both secretion and peristalsis, prevents a return of the constipation. A constipation of long standing may thus frequently be broken up in the course of a week, often with permanent results.

The Evil of Hypercatharsis. — It is highly important to urge a word of caution against the prevalent habit of purging patients excessively before operations. It is not unusual for patients to be forced to have a dozen or more dejections during the twelve or twenty-four hours before undergoing the ordeal of an abdominal section, and during this time they are kept upon a reduced diet, and often during the final twelve or fifteen hours are given nothing at all to eat. It should be borne in mind that such hypercatharsis (*a*) weakens the patient, (*b*) still further weakens peristalsis, (*c*) aggravates post-operative thirst, and (*d*), by draining the circulation, stimulates all of the absorbent functions, and thus lays the foundation for systemic sepsis in the presence of unavoidable local infection. The practice is wholly wrong and should be abandoned.

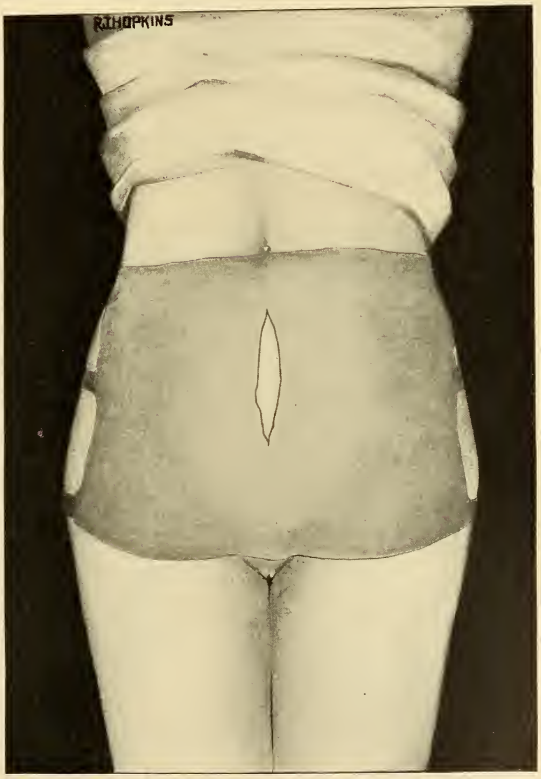

Fig. 31.—"Fenton B. Turck covers the abdominal wall with a sheet of rubber dam."—Reed (page 102).

Examination of the urine is very important, as is the correction, by judicious medication, of any error that may be found in that secretion. The condition of the skin should equally be the object of careful investigation and treatment. This latter precaution is of greater importance than is generally recognised. It is only necessary to mention that failure of the urinary function, as the result of the action of the anæsthetic on the kidneys, is one of the most frequent fatal complications following visceral operations; and that in the presence of such a complication the chief hope of the patient lies in the compensatory activity of the sweat glands. It is highly important, therefore, that they be put in a state of normal activity before the operation. Baths, if necessary, with dry heat or steam and followed by friction, continued during several days, generally constitute all the treatment that is required.

The digestive function should be brought to as high a state of efficiency as possible.

Fenton B. Turck covers the abdominal wall with a sheet of rubber dam (see Fig. 31). This is stretched taut, and, being translucent, does not obscure the underlying integument; the incision is made directly

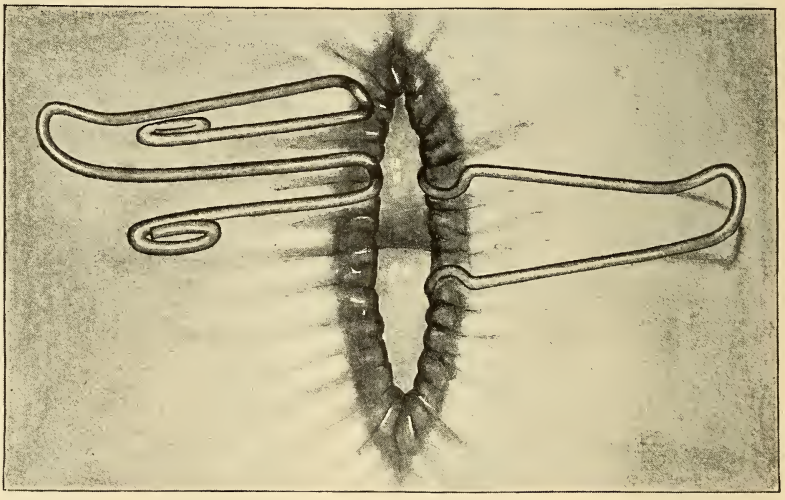

Fig. 32.—"The cut edges of the rubber dam are brought forward and tucked into the wound."—Reed.

through the dam just as if it were a part of the skin. After the incision is completed, the cut edges of the rubber dam are drawn forward and are tucked into the wound, covering its margins and being retained by a clothes-pin arrangement, as shown in the drawing (Fig. 32). The rubber dam is further utilized by Turck in preventing infection of the peritoneal cavity by drawing a loop of intestine to be operated upon through a small hole in the rubber sheet.

Instruments for an Abdominal Section

- Aspirator.
- Cautery (Paquelin).
- Forceps:
  - Long dressing 1
  - Long hemostatic 6
  - Medium hemostatic 3
  - Small hemostatic 3
  - Bullet 1
  - Rat-tooth 2
- Needles, curved:
  - Very large (No. 1) 1
  - Large (No. 4) 2
  - Intermediate (No. 3) 2
  - Small (No. 2) 2
  - Intestinal (No. 1) 2
  - Transfixion, right curved 1
- Needles, straight 2
- Needle holder 1
- Retractors:
  - Large ..... 2 pairs
  - Next size smaller ..... 2 "
- Scalpels 2
- Scissors:
  - Long ..... 1 pair
  - Short ..... 1 "
- Sound, uterine 1
- Speculum, Sims's small 1
- Sponge holders 4
- Tenacula:
  - Straight 1
  - Curved 1

Additional Instruments for Ovarian Cysts

Trocars, large and small. Two Nélaton forceps. Rubber tubing.

Additional Instruments for Extra-uterine Pregnancy, Hysteromyomectomy, or Supravaginal Hysterectomy, and Vaginal or Infravaginal Hysterectomy

One dozen pairs of long hemostatic forceps.
Two Museux's forceps for seizing tumours.

Glassware

- Catheters 2
- Drainage tubes, assorted sizes:
  - Straight 3
  - Curved 3
- Flask, sterilized, to receive fluid (contents of cysts, etc.) for examination 1
- Nozzles (for irrigation) 2

Preparation of the Field of Operation.—(See Preventive Treatment of Sepsis.)

Location of the Incision.—The abdominal incision is generally located in the median line for the reason that this particular situation enables the operator to more freely handle the parts of the abdominal and pelvic cavities. This rule is adopted more particularly in the old operation of Cæsarean section, and in the more recent procedure of *ovariotomy*. In the former instance it was manifestly to the convenience of the operator to get down directly upon the uterus. In the second class of cases it was more desirable because it enabled the surgeon to deal with either side of the pelvis with equal facility; latterly, however, the principle has gained recognition that the incision should be made directly over the organ or structure which is to be dealt with.

The question of hernia resulting from the unsatisfactory restoration of the incised abdominal wall is also an important consideration in determining the location and character of the incision. It is generally supposed that the cut in the median line directly through the linea alba is best calculated to avoid unpleasant consequences. Of the incision in this location, it may be said that it is the easiest to make, and, by avoiding blood vessels, is least complicated with hemorrhage. It is closed with great facility, and the union which ensues is generally very satisfactory. If infection should occur, however, the approximation of the structures, however accurately made, may be destroyed, and the margin of the wound thus become retracted. This is of very serious import when the incision is a little to one side or the other of the median line, and when the separation involves the margins of the fasciæ. This—i. e., separation of the fascia—is the underlying condition of post-operative ventral hernia; to avoid this accident many operators prefer to invade the abdominal cavity a little to one side or the other of the median line, some preferring to go as far to one side as the outer margin of the rectus muscle; some preferring to go directly through the rectus; while still others open the sheath of that muscle near the median line, pushing the muscle itself to one side and continuing the incision through the middle of the underlying layer of sheath and fascia. In this way it is contended that should one layer separate, the other layer, directly superimposed, will exercise a greater retentive power, and thus prevent the development of hernia.

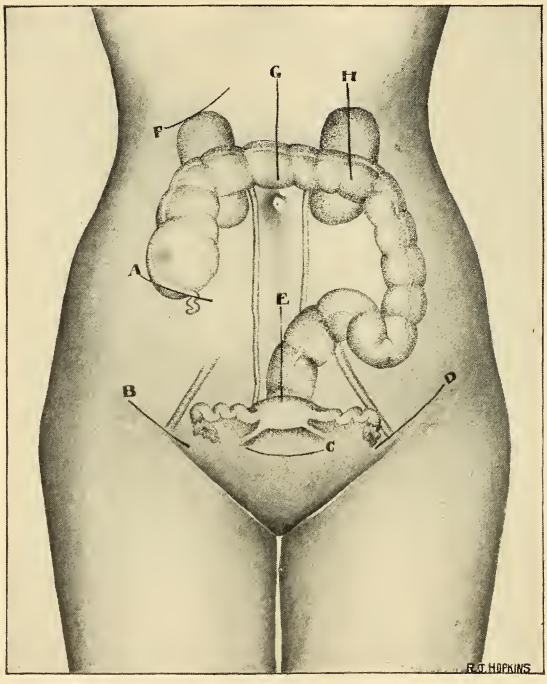

Fig. 33.—"The incision may be made in that locality which will afford the greatest facility in dealing with the underlying internal conditions."—Reed (page 105).

This principle is one which is capable of adoption in many operations. It should be observed, especially in fat subjects, where, in consequence of the disuse of the abdominal muscles, or of the stretching incident to distention by fat, or from the pressure due to the presence

of deposits of adipose tissue, the structures of the abdominal wall are materially weakened. It should be remembered that an incision may be made at any point in the abdominal wall, and that there are no blood vessels contained therein the hemorrhage from which is not readily controllable. As a rule, therefore, the incision may be made in that locality which will afford the surgeon the greatest facility in dealing with the underlying internal conditions (Fig. 33).

Direction and Varieties of Incision.—While the foregoing is true, it is also true that there are distinct advantages to be gained by definitely and accurately arranging the direction of the incision into and through the abdominal wall. It is also true that, consistently with the object in view, the incision is best made (*a*) coincidently with the cutaneous folds, and (*b*) coincidently with the muscular fibres and fascial *striæ*. This principle was enunciated by Kocher (*Operative Surgery,* New York, 1894), who definitely outlines the incisions to be made for various purposes, some of which come properly within the range of a work on gynecology, and are given herewith. The line of the median abdominal incision is, as already stated, the one most commonly employed. While it is made transversely to the normal cutaneous folds it is coincident with the *recti muscles*, a fact that conduces largely to the easy and permanent approximation of the deeper structures. The results, so far as the skin is concerned, are, however, often somewhat unfortunate, if from no other than an æsthetic point of view. The retraction of the skin that frequently ensues, notwithstanding the most careful approximation of the cutaneous margins, frequently results in post-operative widening of the cicatricial area. Frequently under this influence the scar tissue undergoes what is spoken of as a keloid change. When, therefore, the cutaneous incision can be made transversely, the underlying layers being divided in any direction to suit the operator, but preferably in the direction of their respective *striæ*, the result is always more satisfactory. There is nothing more striking than the difference between a scar made transversely to, and one coincidently with the cutaneous folds, the latter becoming practically imperceptible after a very few weeks, while the former shows a constant tendency to increase in size and to diminish in retentive power.

The Vertical Median Incision.—The incision *E* (Fig. 33) may be called the low vertical median incision, while that designated *G* (Fig. 33) is the high vertical median incision. The latter should be employed in operations upon the stomach, and in other operations in which it is desirable to reach the organs lying in the upper part of either of the upper quadrants of the abdominal cavity. A vertical incision (*H*, Fig. 33) is sometimes made in the left upper quadrant for operations upon the spleen. The incision in the median abdominal line is the best in all cases in which it is necessary to deal with both sides of the pelvis, or in those cases in which it may be uncertain as to which side of the pelvis may be the ultimate seat of operation. The *median line* is, as a rule, the safer *locus* for a general exploratory in-

cision. It should always be employed in the presence of surgical conditions lying immediately beneath it.

The Transverse Umbilical Incision.—This incision is made transversely at the *umbilicus,* and may be employed in dealing with practically all conditions developing in that locality. It is the ideal incision in the management of umbilical hernia. As a rule, a postoperative ventral hernia, occurring in this locality, or, for that matter, at any other point above or below the umbilicus, may be safely and desirably approached through a transverse incision, while the hernia itself should be approximated in a transverse rather than a longitudinal line. This line of incision is of especial importance in fat people. These patients, lying upon their backs, exercise all of the gravity which is derived from the heavy and mobile abdominal walls in a spontaneous tendency to retract from the longitudinal median line, while their equally natural tendency is to hold a transverse approximation in continued apposition.

The Transverse Suprapubic Incision (*C,* Fig. 33).—This incision should be made transversely to the median line, immediately above the pubes, in all operations in which it is desirable to approach the bladder from the outside. This occurs with frequency in gynecological practice.

The Oblique Ventral Incision (*A,* Fig. 33).—The oblique ventral incision should be employed in dealing with the common iliac artery, as sometimes becomes necessary in gynecological practice; it may be used on the right side in dealing with the suppurations about the head of the colon and in appendicitis, or in surgical conditions pertaining to the pelvic bones on that side. On the left side it is the avenue of approach to the sigmoid flexure as well as to the common iliac artery.

The Inguinal Incision (*B, D,* Fig. 33).—The inguinal incision may be made either above or below, but coincidently with, the line of Poupart's ligament. In the former position it may be employed in inguinal hernia or to reach conditions beneath the broad ligament in order that they may be dealt with without communicating with the peritoneal cavity. Suppuration in this locality may be evacuated and drained by an incision along this line, while retroperitoneal myotomy, or, for that matter, intraligamentary cysts, may be approached by this incision, after their true character has once been determined by the incision in the median line.

This incision is sometimes made below Poupart's ligament in dealing with femoral hernia and with conditions connected with the femoral artery.

The Oblique Subcostal Incision (*F,* Fig. 33).—The oblique subcostal incision should be made from a half to three quarters of an inch beneath the costal margins, extending from the outer margin of the rectus muscles to as far around the side as may be necessary. This operation is sometimes desirable in making explorations for the kidney—a procedure which comes within the purview of this work; it is usually em-

ployed, however, for operations upon the gall bladder, which are not considered in this volume.

The Lumbo-iliac Incision.—This incision begins near the last costo-vertebral articulation, extending downward and forward in the direction of the crest of the ilium. It may be employed in the case of nephrectomy, or for the complete removal of the ureter.

The Lumbocostal Incision.—This incision is made from a point one to two inches to the side of the posterior median line, and carried obliquely downward, forward, and upward below the costal margin. It is employed for operations upon the kidney.

General Observations on making the Incision.—Wherever the incision may be located it should be made deliberately, all attempts at haste being avoided. The layers should be incised one by one. Bleeding points will, of course, be encountered, some localities and some patients being more vascular than others. The blood should be speedily wiped away by means of a bit of dry sterilized gauze, so that the structures may be kept clearly in view. The gauze thus used should be immediately thrown away. Much time is often lost in needless attention to unimportant bleeding. As a rule, that bleeding which is merely capillary or venous may be left to itself, while a pulsating jet should be at once controlled by means of a hemostatic forceps. This should not be hastily applied, and should always be adjusted with care and precision. Many careless operators and assistants simply take a large

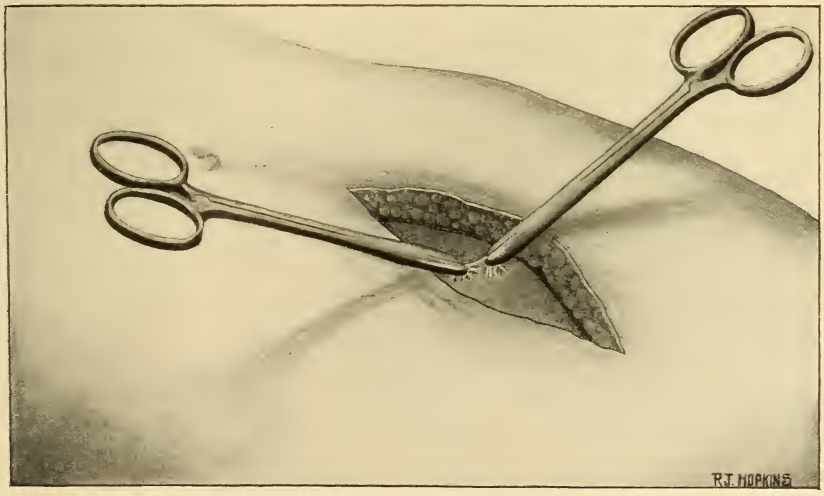

Fig. 34.—"The presenting structure should be picked up by two hemostatic forceps."—Reed.

bite of tissue somewhere in the neighbourhood of the bleeding point, with the object, of course, of controlling the hemorrhage. The pressure thus imposed upon the tissue, particularly the adipose tissue, which is found in such abundance in the abdominal wall, is liable to induce

necrosis, and thus interfere with primary union. A few seconds of time should be taken to isolate more or less definitely the bleeding point, which should then be picked up accurately by the point of the hemostatic forceps.

As soon as the deep fascia or the subperitoneal fat is reached, the presenting structure should be picked up by two hemostatic forceps (Fig. 34), which should be reapplied as often as may be necessary to hold the peritoneum away from the underlying viscera. The moment the peritoneum is nicked the air rushes in and the intestines fall away from the abdominal wall. Failure to observe this precaution sometimes results in the totally unnecessary wounding of the intestines or other structures within the abdominal cavity. The peritoneum should be carefully incised by means of either scissors or a knife, coincidently and coextensively with the upper part of the incision (Fig. 35).

Fig. 35.—"The peritoneum should be carefully incised . . . coincidently and coextensively with the upper part of the incision."—Reed.

As soon as the peritoneum is opened, care should be taken to permanently arrest all hemorrhage in the abdominal incision and to remove the forceps. In the course of an operation it may be, and frequently is, necessary to enlarge the incision; in doing so great care should be exercised to make the additional opening directly in line with the previous one, and to observe the same precautions in dealing with the incidental hemorrhage. It is better to employ a knife for this purpose rather than the scissors, which are generally so convenient, so expedient, and so generally utilized by the hurried surgeon. The scissors are objectionable, because in the act of cutting they produce a certain amount of cell destruction, which is

obviated by the keener edge of the knife. The incision having been made as large as necessary, the operation, whatever it may be, is carried to completion.

The Closure of an Abdominal Incision.—There are various methods of closing the abdominal incision. The question of interrupted or continuous suture, the question of suture material, and the question of sealing or not sealing the wound, are all to be considered; this is better done with reference to the necessity or not of maintaining drainage.

The Immediate and Complete Closure of an Abdominal Incision.—When the operation has been successfully concluded, when the field of operation has remained free from infection, when hemostasis has been secured, and when there are no remaining doubts as to the safety of the internal conditions, the abdominal wound may be closed completely and at once by one of the following methods:

Closure by the Laminated Suture.—The ideal method of closure is by the approximation, edge to edge, of like structures; thus the peritoneum to the peritoneum, the tranversalis fascia to the transversalis fascia, the superficial fascia to the superficial fascia, and the integument to the integument, should be successively approximated. This may be done either by continuous or interrupted suture or chromicized or formalinized catgut. The kangaroo tendon and other tendinous materials have a certain vogue for this purpose, but they are not essential to success. If a continuous suture is applied in each layer it ought to be supplemented by a number of interrupted sutures in the fascial layers, as these structures are more prone to retract than are the others, and they are likewise the chief retentive tissues of the abdominal wall. It is not safe, therefore, to trust their approximation to a single continuous suture. The application of the sutures to the various layers is largely facilitated by drawing up, by two small volsella forceps, each consecutive layer into the field of operation (Fig. 36). Volsella forceps are vastly better adapted to this purpose than are those used for hemostasis, because they exercise no pressure, and consequently induce no cell destruction. The skin should be closed by means of intercutaneous suture, but before starting this suture the end should be fastened

Fig. 36.—"The application of the sutures to the various layers is largely facilitated by drawing up, by small volsella forceps, each consecutive layer into the field of operation."—Reed.

in such a way as to place the knot deep in the subcutaneous fat (Fig. 37) in order that its absorption may be insured. This is done by passing the needle through the subcutaneous fat from beneath, carrying it across to the other margin of the wound, and downward through the fat, bringing it out at a point corresponding to the original insertion on the other side. The suture is now tied and the short end cut close. In order to secure perfect approximation at the end of the wound, the first intercutaneous suture is passed toward the end from which the suture starts (Fig. 38). The remaining sutures are passed in the other

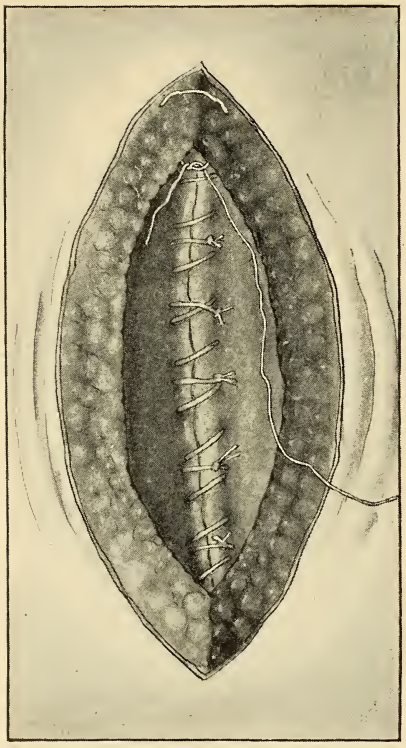

Fig. 37.—"The end should be fastened in such a way as to place the knot deep in the subcutaneous fat."—Reed.

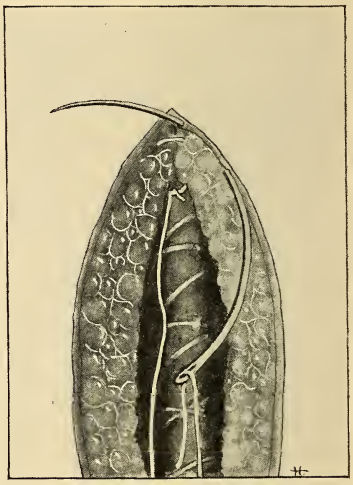

Fig. 38.—"The first intercutaneous suture is passed toward the end from which the suture starts."—Reed.

direction, the margins of the skin being carefully drawn together (Fig. 39). There are connected with this last manœuvre certain dangers, for instance, the unsuccessful application of the sutures, leaving a gaping point to serve as an infection atrium; or, on the other hand, if too tightly drawn after they have been inserted, the pressure itself may be destructive of the integument and may result in a necrosis, which is disastrous to primary union. After having applied the intercutaneous suture there may be some retraction of the subcutaneous fat, a condition which is easily remedied (Fig. 40). This is done by taking a long curved needle, inserting it an inch or less back from the line of incision, crossing the incision itself, and bringing the needle out at a corresponding distance on the other side. The needle is then rein-

serted through the aperture of exit, and is carried in a more or less oblique way back to the opposite side, where it is brought out half an inch distant from the point of original insertion (Fig. 41). The suture thus buried approximates the underlying fat, and in an important degree fortifies the cutaneous approximation. It is returned in the same manner until the whole line of incision has been brought under the influence of the suture. It is then tied under the skin by inserting the needle and working its point two or three times around the strand of catgut immediately under the skin. The needle is then brought out on the other side and the catgut excised under traction close to the skin. The end immediately retracts and the whole operation will have been completed entirely beneath the integument.

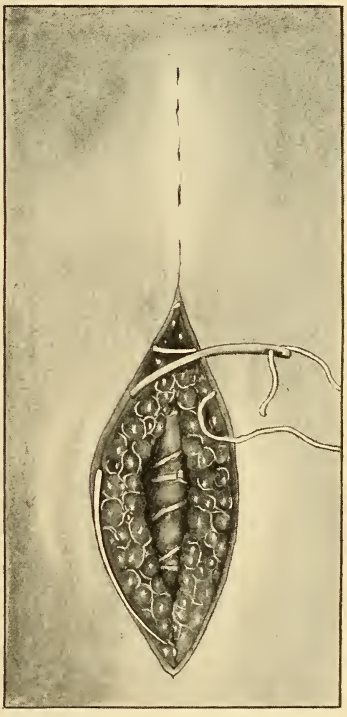

Fig. 39.—"The remaining sutures are passed in the other direction, the margins of the skin being carefully drawn together."—Reed (page 110).

It is well in the majority of cases to seal the wound by adjusting over it a little sterilized gauze fixed to the surface by means of collodion, but the impossibility of sterilizing collodion should prevent its application directly to the margins of the wound. After the abdomen is well cleansed and dried it should be tightly bound with a cloth bandage. That in use at the Cincinnati Hospital is probably more advantageous than others, it being held firmly in place by two flaplike elongations of the back part which are brought up between the thighs and fastened to the front of the bandage (Fig. 42).

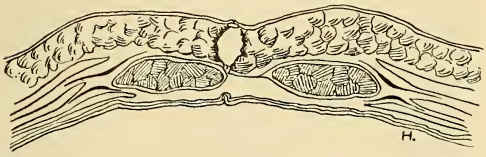

Fig. 40.—"After having applied the intercutaneous suture there may be some retraction of the subcutaneous fat, a condition which is easily remedied."—Reed (page 110).

Closure where Drainage is Necessary. — In many operations it is not possible to secure complete hemostasis or that degree of asepsis compatible with safety, or to control other surgical conditions to a degree that will justify the complete closure of the abdominal incision. Drainage must, therefore, be employed and an orifice of exit must be provided. This is sometimes

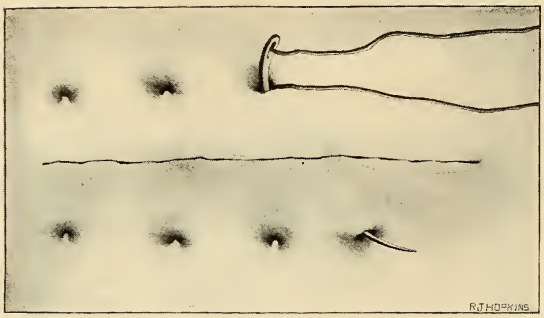

Fig. 41.—"The needle is reinserted through the aperture of exit, and is carried in a more or less oblique way back to the opposite side."—Reed (page 111).

done by making an opening in the cul-de-sac of Douglas and carrying a self-retaining tube out through the vagina. In other instances this will not suffice. Many operators still cling to the old glass tube and pump, while in certain other instances it is necessary to pack the field of operation with gauze and bring one end of it out through the incision. The necessity for the latter expedient is sometimes so great as to make it necessary to leave open the entire wound. Under any of these circumstances it is necessary to leave a part or all of the incision open. In such cases it is not better to employ the buried animal suture, for the reason that the drainage, however established or however maintained, is necessarily a fruitful source of infection; and infection once communicated to the continuous laminated animal suture is liable to invade all of the structures that may be approximated by it.

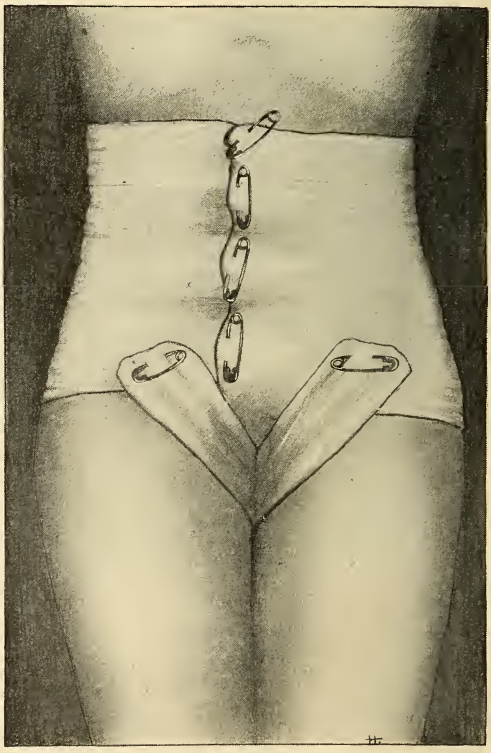

Fig. 42.—"The bandage in use at the Cincinnati Hospital is probably more advantageous than others."—Reed (page 111).

Closure by the Suture En Masse.—To close the wound when drainage is required, the suture *en masse* should be employed. This may consist of silk, silver wire or silkworm gut—the latter on all accounts being preferable. The material, having been sterilized, of course, may be inserted from the skin to the peritoneum, carried across from peritoneum to peri-

toneum and through from peritoneum to skin. For this purpose many operators prefer a straight needle, others a curved one; the most satisfactory one which the writer has encountered has been devised by Dr. J. B. S. Holmes, of Atlanta, Ga. It is a round needle bent at an angle near the point, which has a bayonet finish (Fig. 43). The needle in passing through the abdominal wall should be made to define an arc of a circle, so that when drawn together the intermediate structures will be brought well forward and forced into approximation (Fig. 44). In a few instances it may be found necessary to bring the traction to bear more specifically upon the margins of the fascia. This is accomplished by a figure-of-eight arrangement, effected as follows: The needle is inserted through the skin and superficial fascia, brought out into the margin of the wound, inserted into the opposite side just below the superficial fascia, carried through the peritoneum, crossed over, inserted through the peritoneum and brought out just beneath the superficial fascia, crossed over to the other side, inserted through the superficial fascia, and brought out through the skin. The resulting suture is a complete figure eight, which forces into approximation the fascia which, under many circumstances, is prone to retract to a degree calculated to defeat the union (Fig. 45). The sutures having been inserted, the ends are gathered together upon either side and the entire abdominal wall is drawn away from the intestines, the peritoneal margins being forced together by properly directed traction upon all the sutures. This having been done, the ends of the sutures may be permitted to lie freely while the operator ties each one *seriatim*. If the material is silkworm gut the preliminary loop of the knot should be accomplished by three turns, and should be drawn together with just sufficient force to effect the approximation of the tissues, but without force enough to interfere

Fig. 43.—The needle devised by Dr. J. B. S. Holmes.—Reed.

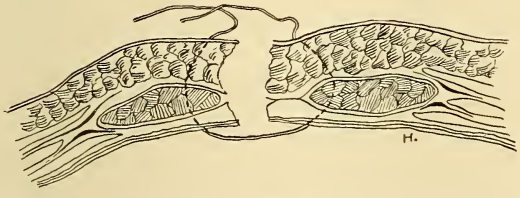

Fig. 44.—"The needle, in passing through the abdominal wall, should be made to define the arc of a circle."—Reed.

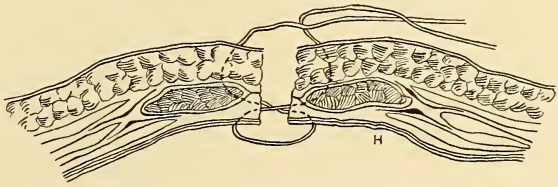

Fig. 45.—"The resulting suture is a complete figure of eight."—Reed.

with the local nutrition of the parts. A suture that blanches the skin under it is tied too tightly. This can not always be avoided, because the post-operative engorgement of the parts sometimes increases pressure to a dangerous degree. If the suture has been secured as already indicated—namely, by an extra whirl in the preliminary loop—it is totally unnecessary to apply the usual second loop for fixation. If, then, the tension should subsequently appear to be too great, the suture can be loosened. An extra suture may be inserted to secure approximation at the point occupied for drainage. If applied, this suture should be left loose until after the drainage is concluded. It may be stated, as a rule, however, that this expedient is one of doubtful utility, and is not infrequently fraught with some danger. It is better, as a rule, to leave that section of the wound which has been employed for drainage open for spontaneous closure.

Drainage.—Drainage was at one time considered more essential to success in abdominal surgery than it is at the present day. At the time when surgeons were less sure of hemostasis it was a safeguard in detecting internal hemorrhage, and it should yet be employed in all cases in which the operator has any doubt about having controlled the bleeding. In former times, when the toilet of the peritoneum was less carefully made than at present, drainage was essential for the escape of pus, which continued to form until limited by the self-extermination of its micro-organisms. Drainage may be practised by leaving in the abdominal wound a glass tube extending to the bottom of the pelvis. Through this tube the accumulated fluids are sucked with an apparatus consisting of either a syringe or a rubber bulb with a glass barrel attached to a bit of rubber tubing. The manipulation requires great care to prevent infection, the liability to which by this means constitutes one of the chief objections to drainage as a routine measure. In many abdominal operations in which it is desirable to promote the escape of fluid, drainage is effected by making an opening in the floor of the cul-de-sac of Douglas and inserting through that into the vagina either a small rope of gauze, or preferably a T-drainage tube. These are made of rubber after the pattern of Martin, but as found in the shops are unnecessarily expensive. Just as efficient a drainage tube can be made by taking a piece of ordinary quarter-inch drainage tubing, eight inches long, and cutting it off oval at one end. The tube is then split for a distance of an inch and a half into two flaps; an eighth of an inch below the base of each flap a small hole is cut into each side of the tube; through each of these holes the corresponding flap is drawn by means of an ordinary hemostatic forceps; the result is the formation of a T-tube of great utility (Fig. 46). Delagénière has devised metal drainage tubes, but their advantages are not obvious. Gauze has been used for drainage purposes, but it speedily becomes filled with the secretions, which it fails to conduct out of the cavity; its use, therefore, should be limited to those cases in which the fluid expected to be taken out by it is not in excess of the absorbing capacity of the gauze to

be used. J. G. Clark investigated the general question of drainage in seventeen hundred abdominal sections at the Johns Hopkins Hospital (*American Journal of Obstetrics*, April, 1897). In approaching his investigations he proceeded upon the conclusions of Muscatello—

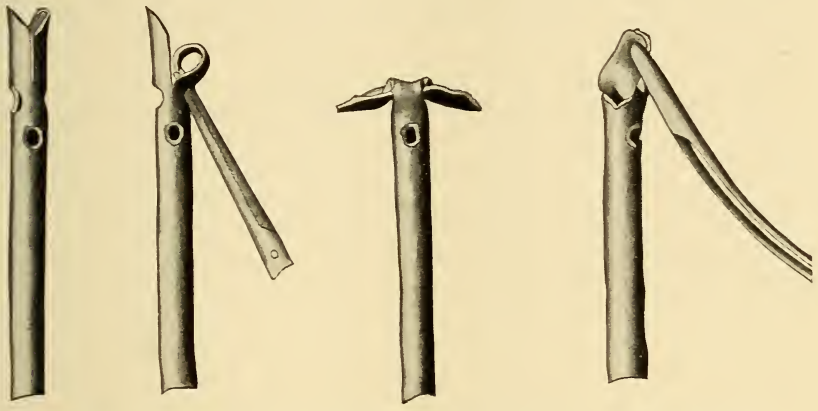

Fig. 46.—"The result is the formation of a T-tube of great utility."—Reed (page 114).

viz.: (1) the surface of the peritoneum is equivalent to that of the skin; (2) it has an enormous absorbing function, taking up in an hour from 3 to 8 per cent of the entire body weight; (3) under the influence of very toxic or very irritant substances an equal transudation into the peritoneal cavity may take place. Clark, from a general study of the subject as well as from these investigations, concludes that—

1. Fluids and solids may pass through the endothelial layer of the peritoneum, the fluids in many places, the solid particles only through the spaces in the diaphragm.

2. The minute solid particles are carried into the mediastinal lymph vessels and glands, and thence into the blood circulation, by which they are distributed to the abdominal organs and lymph glands.

3. Large quantities of fluids may be absorbed by the peritoneum in an astonishingly short time.

4. The leucocytes are largely the bearers of foreign bodies from the peritoneal cavity into the mediastinal lymph glands.

As the result of the experimental study of infection of the peritoneum by Grawitz, it has been shown that—

1. The introduction of nonpyogenic organisms into the abdominal cavity, either in small or large quantity, or mixed with formed particles, produces no harm.

2. Great quantities of organisms, which ordinarily produce no disturbance, may give rise to a general asepsis if the absorptive ability of the peritoneum is impaired.

3. The injection of pyogenic organisms into the peritoneal cavity may be quite as harmless as injection of the nonpathogenic varieties.

4. The introduction of pus-producing cocci causes a purulent peritonitis (*a*) if the culture fluid is difficult of absorption; (*b*) if there is present irritating material which destroys the tissues of the peritoneum, and thus prepares a place for the lodgment of organisms; (*c*) if a wound of the abdominal wall is present which forms a nidus for the infectious process. In this latter case purulent peritonitis will certainly be produced.

It was further found that the area drained by a tube speedily became limited, almost to the circumference of the tube itself; that the tube frequently acted mechanically, and thus perpetuated the peritoneal exudation; that the serum thrown off by the peritoneum acted as the best possible culture medium for germs introduced from without; and, finally, that any agents that had any possible effect upon bacteria acted as an irritant to the peritoneum, and thus defeated the purpose for which they were employed.

CHAPTER XIII

THE EXTERNAL ORGANS OF GENERATION IN WOMEN

Names and definitions—Development—The vulva and its malformations: atresia; infantile; double; persistent cloaca; persistent urogenital sinus; epispadias in women; precocious development; individual malformations of the labia, clitoris, and perineum; pseudo-hermaphroditism: (*a*) masculine, (*b*) feminine—The vagina and its malformations: absence; atresia; stenosis; double or septate—The hymen and its malformations: atresia; double; absence; anomalies in (*a*) form, (*b*) structure, (*c*) anterior extension.

The external organs of generation in women consist of the pudendum and vagina. The pudendum embraces the structures known as the mons veneris, the labia majora, the labia minora, the clitoris and prepuce, the vestibule and fourchette, and the hymen. The word "vulva" applies to all of these external structures except the mons veneris. For convenience of classification the perineum will be considered in this same group.

Development of the Genital Organs.—The genital organs, whether male or female, have their embryologic origin in the Wolffian body, Müller's ducts, and the genital glands. From the Wolffian body, or the primordial kidney, there appear on the inner portion, and in the fifth and sixth months of utero-gestation, the genital glands, which subsequently evolve into either ovaries or testicles. If, however, at the end of the third month, when differentiation of sex is manifested, the genital glands develop into ovaries, the Wolffian body and canal atrophy, almost disappearing, and leave as their only remnant the organ of Rosenmüller in the broad ligament. Müller's duct, however, persists, and from it are developed the Fallopian tubes, while the round ligament is developed from the yet persisting ligament of the Wolffian body, blending, however, with Müller's ducts at the junction of the superior with the middle third. The external organs of generation are derived from the genital tubercle, which appears at about the sixth week of fœtal life and reaches its maturity during the succeeding two weeks. After the development of the genital folds and at the end of the second month there is recognisable on its posterior surface a furrow extending in the direction of the cloaca and designated the genital groove. This is the beginning of sex development, the subsequent steps of which, as outlined by Pozzi, are as follows: "The genital groove does not close more in front than behind, and thus the female lacks the clitoridian

portion of the urethra; and this canal in the adult opens at a point homologous with that where it was found in the fœtus of eight weeks—a disposition which is found in the male when the proper development of the parts has been arrested (hypospadias). The corpus spongiosum of the urethra, the product of the erectilized borders of the genital furrow, is also completely developed in the male and entirely surrounds the canal in the pendulous portion. But in the female it aborts in the intermediate or vestibular portion, being reduced below to its two extremities extending to the bulb of the vestibule, homologue of the bulb of the male urethra, but divided by the persistent genital opening; and above, it forms the glans of the clitoris, which covers the corpora cavernosa clitoridis, homologues of the similar structures in the male penis. At the internal part of the bulb of the vestibule there are vestiges of a membranous organ, which reaches its full development in the male—namely, the bulb of the urethra; it is this which forms the hymen. Above, joining bulb and hymen to the clitoris and representing the vertical or cylindrical portion of the masculine corpus spongiosum, there is in the female a band with a vascular bundle running into it, the frænum masculinum vestibuli." (*Medical and Surgical Gynecology,* vol. ii, p. 436.)

When the ducts of Müller coalesce by the approximation of their internal thirds they naturally form a bifurcating double tube divided at the lower extremity by a septum with two divergent ends above. As development progresses this septum disappears, leaving the rudimentary vagina below and the rudimentary Fallopian tubes above with no intervening uterine body. At the end of the fifth month, however, there occurs at the upper end of this rudimentary vagina a deposit of tissue, which marks the beginning of the uterus. The failure of the septum to disappear from the rudimentary vagina results in the development of a double vagina; while its disappearance from the vagina, but its failure to disappear from the uterine extremity of the rudimentary canal, results in the development of a double, or bicornate, uterus. (See Malformations.)

Malformations of the vulva may lead at the time of birth to an erroneous declaration of the sex of the individual, and later on they may disqualify for marriage; the importance of vaginal anomalies usually becomes apparent when labour is in progress; and the structural irregularities of the hymen commonly produce menstrual retention at the epoch of puberty, or interfere with the consummation of the act of coition some years afterward.

Malformations of the Vulva

The embryology of the vulva is less clearly understood than that of the uterus; it is in consequence of this that its malformations have not been so completely systematized as have those that affect the uterus. When the changes which take place at the posterior end of the embryo in connection with the development of the

genital tubercle, the cloaca, and the urogenital sinus, are better known, the anomalies which arise from interference with the normal course of these changes will be more easily comprehended. The complexity of the embryogenesis of the neighbourhood of the *Bauchstiel* is increased by the occurrence of transitory structures or scaffoldings which give place in time to the permanent arrangement of parts, but which may, under certain circumstances, persist more or less completely, and thus give rise to malformations. A good instance of this permanence of temporary scaffoldings is found in atresia ani vaginalis.

Vulvar Atresia.—Complete absence of the vulva, the skin passing unbroken from the symphysis pubis to the coccyx, is a matter of teratological interest solely; on the other hand, apparent vulvar atresia, or *atresia vulvæ superficialis*, has an immediate importance. On account of the existence of labial adhesions, there is an apparent absence of the vulvar cleft (Fig. 47). A small opening exists anteriorly from which the urine issues sometimes with considerable difficulty. At puberty trouble may arise through the occurrence of hematocolpus; but if the opening is large enough to permit the escape of the menstrual fluid, the discovery of the anomaly is postponed till marriage, when attempts at penetration by the husband may succeed in breaking down the labial adhesions or may require to be supplemented by the knife of the surgeon. It is noteworthy that while this atresic condition may prevent coitus, it is not a complete obstacle to impregnation. The treatment is simple: sometimes the labia can be torn apart, as was done by Jan (*Indian Lancet*, vol. vii, p. 123, 1896); at other times it may be necessary to pass a sound in at the anterior opening (Fig. 48), to direct it backward, and then to cut down upon it (Coop,

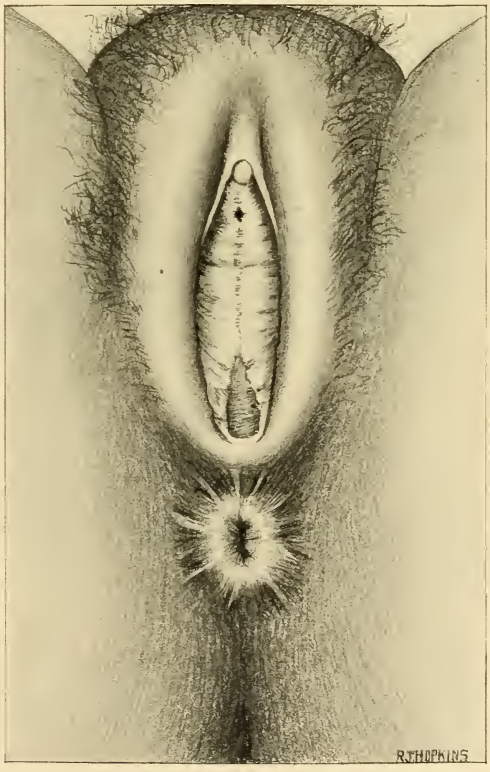

Fig. 47.—"On account of the existence of labial adhesions, there is an apparent absence of the vulvar cleft."—Ballantyne.

American Gynecological and Obstetrical Journal, vol. vi, p. 594, 1895). When the atresia of the vulva is associated with hypertrophy of the clitoris, doubts as to the sex of the individual may arise.

An anomaly closely allied to that just described consists in the existence of preputial and labial adhesions binding down the clitoris. This leads to, or is at least associated with, nervous derangements both in childhood and adult life. The freeing of the clitoris from these adhesions may be followed by the disappearance of symptoms, in this respect resembling the effect of circumcision in the male.

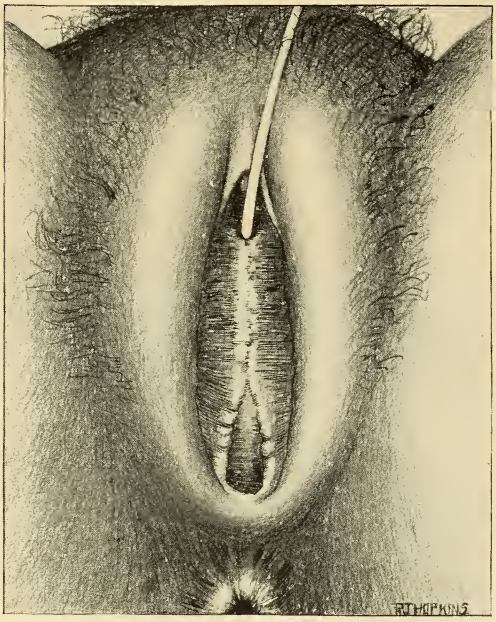

Fig. 48.—"It may be necessary to pass a sound in at the anterior opening."—Ballantyne (page 119).

Infantile Vulva.—In infancy the labia majora are less developed in comparison with the other parts, and the vulvar cleft is consequently more exposed to view; the mons also is but slightly marked, and there is an absence of hair. These infantile characters may persist in adult life. In individuals showing this persistence, there is commonly also an imperfect development of the uterus, ovaries, and mammary glands; chlorosis may be present, and the whole clinical picture may be called infantilism in woman.

Double Vulva.—Only three cases (those reported by Le Cat, 1765; Suppinger, 1876; and Chiarleoni, 1894) are on record in which individuals, otherwise single in formation, possessed two vulvæ situated side by side in the interfemoral space. In two of these there was an imperforate condition of the anus, the rectum opening into the vulva or into the vagina. A case in which the external genital organs of both sexes were present was reported by Moostakoff in a Bulgarian journal (*Meditzina*, p. 32, 1894; abstract by Ballantyne in *Teratologia*, vol. ii, p. 234, 1895), and a similar instance (Fig. 49) has been described by Neugebauer (*Monatsshrift für Geburtshülfe und Gynäkologie*, Bd. vii, p. 550, 1898). It is probable that in both these latter cases the two sets of organs were really of the same sex, one, however, being so deformed as to resemble the appearance presented by the part of the opposite sex. The corresponding malformation in the male is diphallus, or double

penis, twenty cases of which, including one personal observation, Ballantyne and Skirving (*Teratologia*, Bd. ii, p. 92, 184, 255, 1895) gathered together and analyzed. Both in diphallus and in double vulva there is good reason to believe that the anomaly is truly a duplication of the lower end of the trunk—that it is, in fact, the least degree of posterior dichotomy. This view is strongly supported by the fact that in several of the cases that have been dissected there has been discovered bifidity of the lower end of the vertebral column as well as duplication of the external genital organs. Ballantyne has reported an

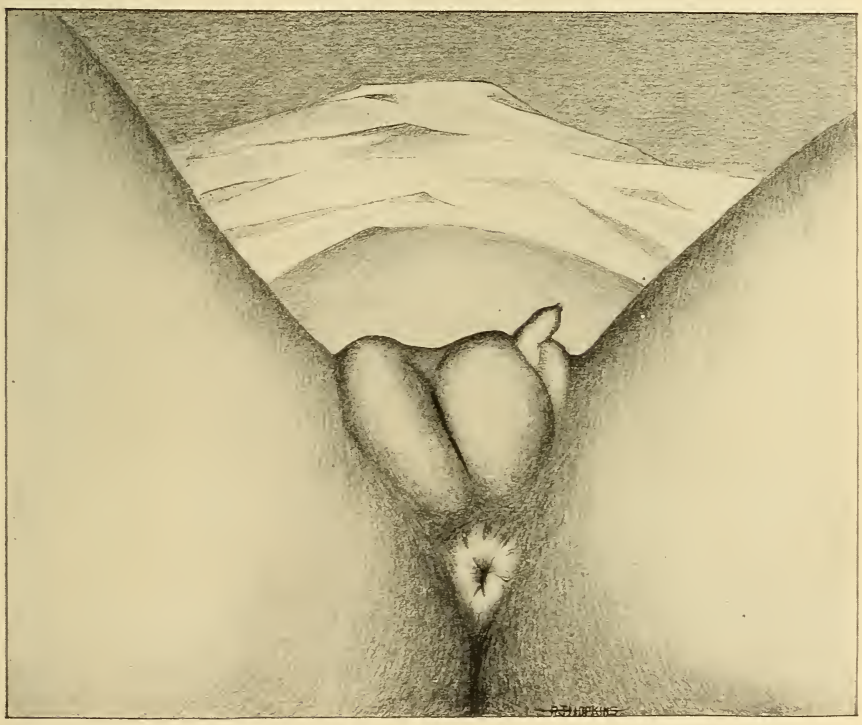

Fig. 49.—"A case in which the external genital organs of both sexes were present."—Ballantyne (page 120).

instance of double genital tubercle (without any other trace of external genitals) in a fœtus with exomphalos and sacral meningocele (*Transactions of the Edinburgh Obstetrical Society*, vol. xxiii, p. 36, 1898).

Persistent Cloaca.—Under the various names of anus vulvalis, vulvar anus, atresia ani vaginalis, atresia ani vestibularis, and vulvovaginal anus, has been described an anomaly which is really due to the persistence of the cloacal stage of the development of the female generative organs. There is no anal opening in the normal position, but fæces pass from the vagina (Fig. 50). Examination reveals an open-

ing, which may be pinhole in size, in the neighbourhood of the hymen or at a slightly higher level in the vagina; this is the lower end of the rectum. J. W. Ballantyne has recently had a case brought under his notice by Dr. George Elder, in which, in a girl four months old, there were *two* vulvar anal openings between the posterior commissure and the hymen; there was a dimple where the normal anus should have been. Sometimes, but rarely, the anomaly coexists with a normal anal opening. It is noteworthy that in quite a number of the reported cases there was control over the motions. Under such circumstances the malformation might pass unrecognised till after marriage or the occurrence of labour. When, however, there is fæcal incontinence, operation becomes imperative. The time of puberty is that best suited for interference; and it is commonly recommended that a probe be passed in at the vulvar end of the fistulous tract and brought out at the spot where the anus ought to be, and that the structures between the director and the surface of the perineum be divided and the rectum pulled down and fixed by sutures. Buckmaster (*Transactions of the American Gynecological Society*, vol. xix, p. 275, 1894), however, advises that the rectal canal be brought down in front of the sling formed by the fibres of the levator ani muscle and fastened without strain; that a second operation be performed for the restoration of the perineum; and that finally the fibres of the levator ani be split so as to form a sphincter very much as has been done with the rectus muscle in gastrostomy.

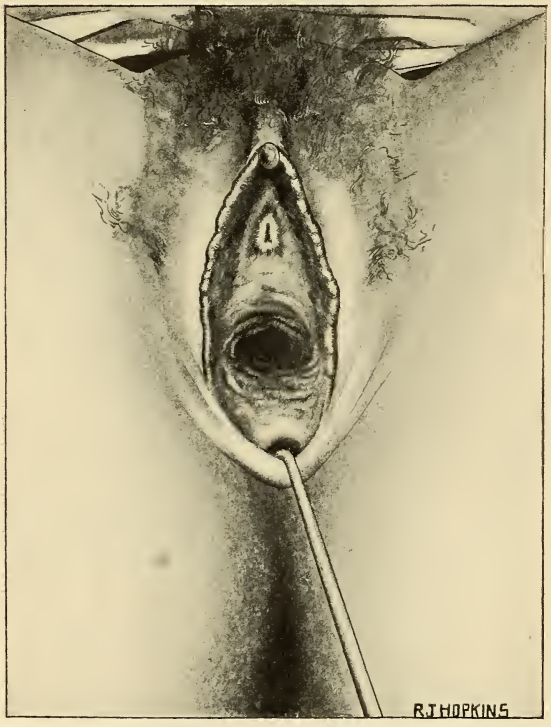

Fig. 50.—"There is no anal opening in the normal position, but fæces pass from the vagina."—Ballantyne (page 121).

Persistent Urogenital Sinus.—The name hypospadias in woman has been given to the condition in which the urethra appears to open into the vagina at a higher level than is normal (Fig. 51); this is really

persistence of the urogenital sinus, for what is called the lower end of the vagina in these cases is more correctly described as the urogenital sinus. It differs from persistent cloaca in the fact that the perineum and anal opening are normally formed and situated. There is a greater or less defect in the posterior wall of the urethra. Clinically, cases of this kind will be grouped according as there is or is not incontinence of urine. If there is no incontinence, as in the case reported by W. A. Edwards (*American Gynecological and Obstetrical Journal*, vol. vi, p. 449, 1896), the individual may pass through life and even give birth to children without the anomaly being detected. But in the other case it will be necessary to operate, and the method of Gersuny may be adopted, as was done with success by Krajewski (Bitner, *Przeglad Chirurgiczny*, vol. i, p. 260, 1893–'94). The urethra is dissected out up to the neck of the bladder, the slit in its posterior wall is stitched, the canal is then twisted on its long axis, and fixed in position by a series of sutures.

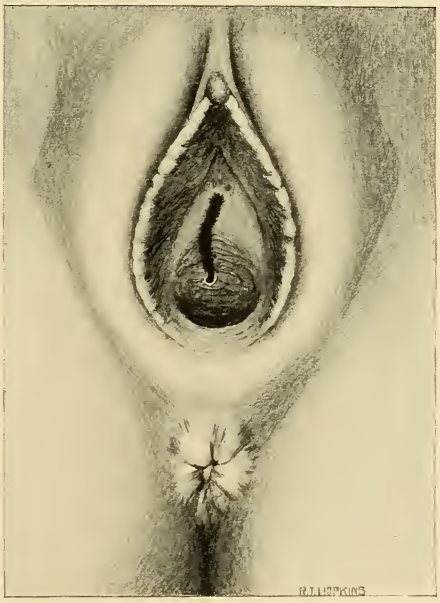

FIG. 51.—"The name hypospadias has been given to the condition in which the urethra appears to open into the vagina at a higher level than is normal."—BALLANTYNE (page 122).

Epispadias in Women.—In women epispadias may be met with as a part of the malformation known as extroversion of the bladder, or it may exist practically alone. To the latter condition the name is best restricted. Ballantyne (*Edinburgh Hospital Reports*, vol. iv, p. 249, 1896) has described a case of this kind and gathered together thirty-two others from literature. It consists, as in Dranitzin's case (*Journal Akush.*, vol. viii, p. 567, 1894), in the absence of a greater or smaller part of the anterior wall of the urethra, with the division of the clitoris into two parts, and the presence of a median groove in the region of the anterior commissure of the vulva (Fig. 52). There is no splitting of the symphysis pubis or anterior bladder wall. It has only one symptom—more or less complete urinary incontinence—and in its least marked form (clitoridian epispadias) even this may be absent. Various plastic operations, resembling those used in hypospadias, have been employed to lengthen and narrow the urethra and to restore the anterior vulvar commissure and clitoris; but success has only been occa-

sionally obtained, and most often the purely palliative wearing of a urinal has had to be accepted as the sole treatment practicable.

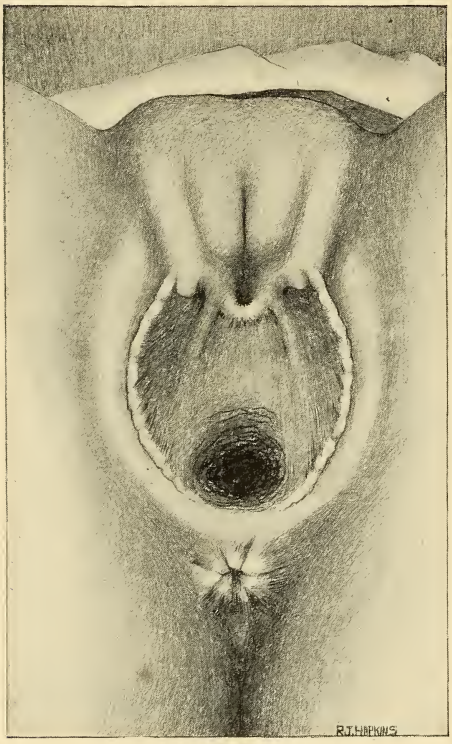

Fig. 52.—"Epispadias may be met with as part of the malformation known as extroversion of the bladder."—Ballantyne (page 123).

Precocious Development of the Vulva.—In strong contrast to the cases of infantile vulva are those of precocious development of it, which are occasionally met with. Girls of from two to ten years exhibit under these circumstances a marked growth of pubic hair; the vulva, as in the adult, is strongly developed anteriorly (de Richemond, *Revue mensuelles des maladies de l'enfance*, tome xvii, p. 74, 1899); and the mammary glands may also show hypertrophy. Physiologically there may be early menstruation or pubertas præcox (Hennig, *Centralblatt für Gynäkologie*, Bd. xxii, p. 832, 1898), and in some instances (e. g., that reported by C. W. Gleaves, *Medical Record*, New York, November 16, 1895) there has been precocious pregnancy.

Malformations of the Labia, Clitoris, and Perineum.—The anomalies that have been described affect more or less all the structures making up the vulva, but the single parts may also be malformed. The labia minora or nymphæ may be absent, or increased in number, or hypertrophied; the clitoris also may be enlarged so as to suggest doubts as to the real sex of the individual. In many of these cases of hypertrophy there exist nervous phenomena, which are occasionally mitigated by excision of the enlarged parts. A curious anomaly of the labia minora has recently been reported by Shoemaker (*American Journal of Obstetrics*, vol. xxxii, p. 216, 1895); the nymphæ were unusually large, and in each there was a congenital circular perforation about half an inch in diameter, and exactly opposite each other. J. W. Ballantyne has described a case of a suspected "hermaphrodite" in which the left nympha was enlarged, pyramidal, and divided into two parts by a constriction (*Transactions of the Edinburgh Obstetrical Society*, vol. xiii, p. 185, 1898).

Pseudo-hermaphroditism: *Masculine.*—It is not out of place in a work devoted to gynecology to refer to cases of doubtful sex in which the individual, by reason of his possession of testicles, is a male, but on account of his external organs might quite well be a woman, for such cases usually are brought to gynecologists for treatment. The anomaly most commonly met with under these circumstances is perineo-scrotal hypospadias (Fig. 53). The imperforate penis, often atrophic, resembles the clitoris; the urethra opening at the base of this rudimentary penis resembles the female meatus urinarius at the base of the vestibule; and the short vestibular canal, which may even be guarded by a hymen, simulates the vaginal orifice in a very striking fashion. Nondescent or atrophy of the testicles, enlargement of the mammary glands, and the exhibition of acquired feminine traits, may all combine to make the question of the sex of the hypospadic male one of the greatest difficulty. When it is added that cases have occurred in which the individual not only possessed a uterus, but also suffered every month from a sanguineous discharge from it, the discovery of the true sex only after post-mortem microscopic examination of the genital glands can be quite well understood. It must also be remembered that the testicles in such cases often show pathologic changes. In an individual described by P. Delagénière (*Annales de gynécologie*, tome li, p. 57, 1899), and regarded for twenty-seven years as a woman, the testicles, which were found in the inguinal regions, showed tubules surrounded by fibrous tissue, atrophied, and containing no spermatozoa. In one of the glands there were also several nodules, "adenomata of the testicle." In this case the vulva was absolutely normal, the breasts were those of a girl before puberty, and the thorax was masculine in type. The abdomen was opened, but no trace was found of uterus or

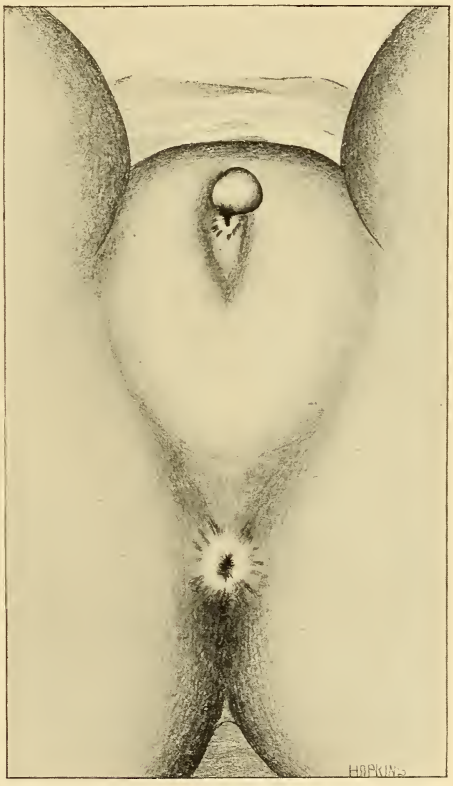

FIG. 53.—"The anomaly most commonly met with is perineo-scrotal hypospadias."—BALLANTYNE.

tubes; the atrophied testicles were removed. If such individuals are seen at the time of birth it is probably best to bring them up as boys, as Lawson Tait suggests, for male pseudo-hermaphrodites are commoner than females, and there is less risk in bringing up a girl among boys than a boy among girls. At a later age the question of removal of the genital glands (nearly always atrophic or morbid either in structure or position) will require to be faced. C. Martin has removed the testicles from an individual brought up as a girl, with the result or sequence that the pubic hair and the breasts developed (*British Medical Journal*, vol. i, 1894, p. 1361); but it is doubtful to what extent we are at liberty in these cases to remove sexual glands even when these are in all probability morbid in structure and possibly functionally inadequate.

Pseudo-hermaphroditism: *Feminine.*—The most common form of gynandria or feminine pseudo-hermaphroditism, is that in which superficial vulvar atresia exists in association with hypertrophy of the clitoris. When there is also hernia of the ovaries into the labia the individual may readily be regarded as a male. In all probability, however, doubts will early arise as to the true sex, and a close inspection of the parts, accompanied possibly by some slight surgical interference, will serve to make plain the matter before any harm is done.

Malformations of the Vagina

The embryology of the vagina is better understood than that of the vulva, and the nature of its anomalies is therefore more evident. Some doubt, however, exists as to the mode of formation of the lower end of the canal and of the hymen. The general view is that the whole of the vagina above the hymen is Müllerian in origin, being produced by canalization of the fused lower ends of the two ducts of Müller; but Berry Hart (*Transactions of the Edinburgh Obstetrical Society*, vol. xxii, p. 18, 1897) looks upon it as Müllerian in its upper part only, and as developed from the urogenital sinus in its lower third by the breaking down of cells derived from the Wolffian bulbs (lower ends of the Wolffian ducts). Nagel's investigations, however, do not support Hart's conclusions, and Webster (*Transactions of the American Gynecological Society*, vol. xxiii, p. 446, 1898) also sums up adversely to them. Nevertheless the anomalies of the vagina present features not easily accounted for by either of the two theories of origin.

Absence of the Vagina.—Cases of complete absence of the vagina, in which careful examination of the tissues lying between the rectum and the bladder reveals no trace of muscular bands, are of pathological interest solely; they occur only in connection with advanced teratological conditions, such as sympodia.

Vaginal Atresia.—There may exist a complete or an incomplete imperforate condition of the vagina; between the bladder and rectum there may be found simply a fibro-muscular cord; in other cases the

vaginal canal may be present in part and imperforate in part; and in yet others there may be a membranous septum at the upper, middle, or lower, third of the vagina. When the lower third of the canal alone is present it is surmised that it is not Müllerian, but derived from the vestibular sinus; its upper boundary would be composed of the lower imperforate end of the Müllerian vagina, or (if the theory of Hart is accepted) of the persistent Wolffian bulbs. The malformed state of the vagina is commonly associated with anomalies in the other genital organs both internal and external; thus, the uterus may be ill developed or absent, and the Fallopian tubes and vulva may, but not so frequently as the uterus, be defective. On the other hand, the uterus and the other genitals may be normal in structure. Sometimes it is stated that the ovaries are absent, but it must be remarked that in cases in which the vagina and ovaries are both absent the sex of the individual can hardly be regarded as female at all. If functionally active ovaries and uterus coexist with imperforation of the vagina, the supervention of puberty usually leads to the retention of blood, in a more or less altered state, in the uterus (hematometra) or tubes (hematosalpinx), or in the perforate part of the vagina (hematocolpus) (Fig. 54). J. W. Ballantyne has recently seen a case (under the care of Dr. Alexander James in the Edinburgh Infirmary) in which the vagina was imperforate in a great part of its extent, and in which the uterus was the size of a three months' pregnancy (hematometra); the patient, a girl twenty-two years of age, had frequently recurring attacks of epistaxis, and a very remarkable feature of the morbid anatomy was the presence of well-marked cervical ribs.

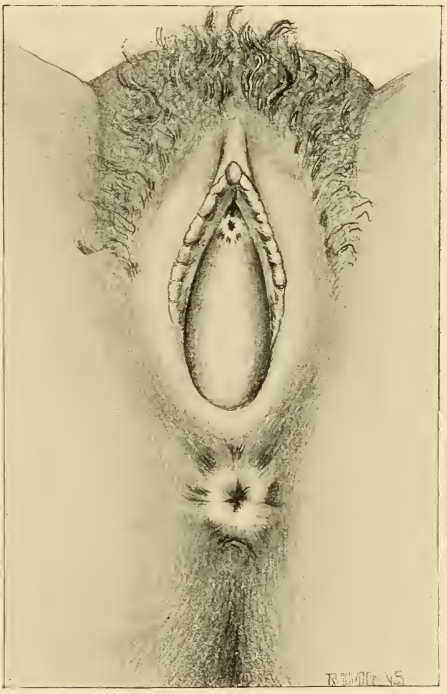

Fig. 54.—"The supervention of puberty usually leads to the retention of blood in the perforate part of the vagina (hematocolpus)."—Ballantyne.

Clinically, an imperforate condition of the vagina usually begins to attract notice when the individual reaches the age of puberty. As month after month goes past without any sign of the menstrual dis-

charge, but with all the signs associated with menstruation (pain and weight in the pelvis, headache, swelling of the breasts, epistaxis, etc.), the patient's friends bring her to a medical practitioner. It is then found that the vagina is imperforate and that there is distention in the hypogastric region, and, if the case is kept under observation, it may be noted that this swelling increases suddenly at recurring monthly periods, to diminish again slowly in the intervals. The examining finger passes into the vagina to a greater or lesser distance, according as the imperforation is high up or low down in the canal, but it never touches the cervix, and by the aid of the rectal touch, with a sound in the bladder perhaps, it can be made out whether the uterus and adnexa are present or not, and whether there is menstrual retention in the uterus and tubes or not. In other cases of vaginal atresia, the first symptoms to lead to medical intervention are those arising at the time of marriage, when coitus is found to be either impossible or incomplete and painful. In these instances the internal genital organs may be functionally quiescent, a fact which accounts for the absence of monthly suffering and for the late discovery of the vaginal anomaly.

The intervention of the gynecologist in cases of imperforate vagina may be rendered necessary under two sets of circumstances—at or soon after puberty, for monthly pain and for hematometra and the symptoms associated therewith; or at the time of marriage for dyspareunia. Under the former circumstances, the object of intervention is to reach and evacuate the retained menstrual blood; under the latter, it is mainly to establish what may be called a coitional vagina by a plastic operation.

If the vaginal atresia is situated near the introitus and is localized, then a simple crucial incision will serve to set free the more or less altered blood in the upper part of the canal; the evacuation should be carried out without haste and strict surgical cleanliness observed. If, on the other hand, the atresia is extensive and the blood accumulation is far from the surface, very careful dissection will be needed before the cervix uteri is reached. With the sound in the bladder and a finger in the rectum, and using the handle of the knife or probe-pointed scissors, the operator will work upward toward the blood accumulation (whose position has been determined by rectal touch), will incise the sac, and endeavour, with the aid of flaps derived from the labia minora and perineum, to form a vaginal canal. Possibly in the future the method of operating recommended by P. Walton (*Belgique médicale*, ann. 5, p. 353, September 22, 1898) will take the place of that described above as more speedy and scarcely more dangerous. He makes an H-shaped incision between the labia minora, dissects upward, and at once opens into the peritoneal cavity (instead of avoiding it, as has been the custom) through the pouch of Douglas; he then passes his fingers in and ascertains the condition of the uterus and adnexa; the opening in the peritoneum can then be closed with catgut sutures and the construction of the artificial vagina proceeded with. In the case operated upon by

Walton, five months had elapsed since the formation of the canal and menstruation had occurred regularly, although in small amount and with complete absence of suffering. The results recently obtained by posterior colpotomy for other conditions support Walton in his recommendation; certainly the operation is greatly shortened, and an accurate knowledge of the position and condition of the parts is obtained.

It is doubtful to what extent the gynecologist is justified in recommending the creation of an artificial vagina when no menstrual sufferings exist, and when there is consequently no reason to suppose that functional internal organs are present, for the operation, which is not free from risk, is manifestly being undertaken solely to provide a coitional vagina. Should intervention, however, be decided upon, it will be best to dissect upward in the space between the rectum and bladder to a distance of about two inches, and then to line this invagination with tissue obtained from the nymphæ and perineum. The cavity will require to be kept open for some time with a cone-shaped pessary.

Vaginal Stenosis.—An abnormal degree of narrowness of the vagina may be met with and may affect the whole canal or only a part of it. When the stenosis is general, it probably means that we have to do with a half vagina derived from one Müllerian duct, the other half being undeveloped, or at least imperforate. Then the condition may be associated with the uterus unicornis or bicornis (with one cornu rudimentary). In other cases the stenosis is annular, and consists of one or more perforated diaphragms, a condition which may have been produced by adhesive colpitis in infancy or in fœtal life, but which more probably represents incomplete canalization of the vaginal *anlage*. Dyspareunia may result at the time of marriage, or delay may occur during the second stage of labour, and the anomaly thus be brought under the notice of the gynecologist. It is usually recommended that a crucial incision be made and the ring stretched; but it will be more satisfactory to adopt the plan advocated by Vineberg (*American Gynecological and Obstetrical Journal*, vol. vi, p. 250, 1895), which consists in excision of the septum and the bringing together with sutures of the upper and lower margins of the annular incision thus produced.

Double or Septate Vagina.—The term double vagina should in strict accuracy be applied only to those cases in which there exist two uteri and two vulvar apertures in addition to the two vaginæ; such cases, as has been stated already, are exceedingly rare, and must be grouped among the double monstrosities. On the other hand, septate vagina, which is usually named "double" vagina, is much more common. It is due to want of fusion of the two Müllerian ducts in their lower part; it is not, therefore, an anomaly by excess, but by defect, an arrested development. The septum generally runs antero-posteriorly, when, of course, the vaginæ are situated laterally; rarely, as in a case reported by Fordyce (*Teratologia*, vol. i, p. 72, 1894), the canals lie one in front of the other and the septum is transverse. The septum may be complete

and may extend from a point above between the two cervices (there are often two vaginal portions, indicating a double uterus) to the vulvar aperture, where it may subdivide that orifice and produce what is called a *hymen biforis*; on the other hand, it may exist in the upper part of the vagina alone, or in the lower part alone, or it may show a varying number of perforations.

Clinically, septate vagina may give rise to no symptoms till parturition occurs, when, as in a case recorded by Ranieri (*Annali di ostetricia e ginecología*, xvi, p. 473, 1894), excision of the septum may be needed during the labour to prevent laceration of it, which might entail also laceration of the uterus. When, however, one or both halves of the vagina are imperforate (a not uncommon occurrence in septate vagina, Fig. 55) symptoms will arise about the time of puberty in association with the retention of blood in one or both canals (unilateral or bilateral hematocolpus). When unilateral, this condition has been called *atresia vaginæ lateralis*. Since the retention of blood may cause pain in the back and difficulty in micturition and defecation, it will be necessary to incise (or better to excise) the sac, clear out its contents, and pack with iodoform gauze under antiseptic precautions. In all cases in which an elastic swelling is found in the vaginal wall, the possibility of its being an imperforate half vagina communicating with a functionally active half uterus should be borne in mind. In a case seen by Muret (*Revue médicale de la Suisse romande*, p. 280, May 20, 1895) the better developed half was imperforate and the more rudimentary one was patent. Sometimes the imperforate half communicates with the patent by means of a small opening, when dysmenorrhœa may exist without com-

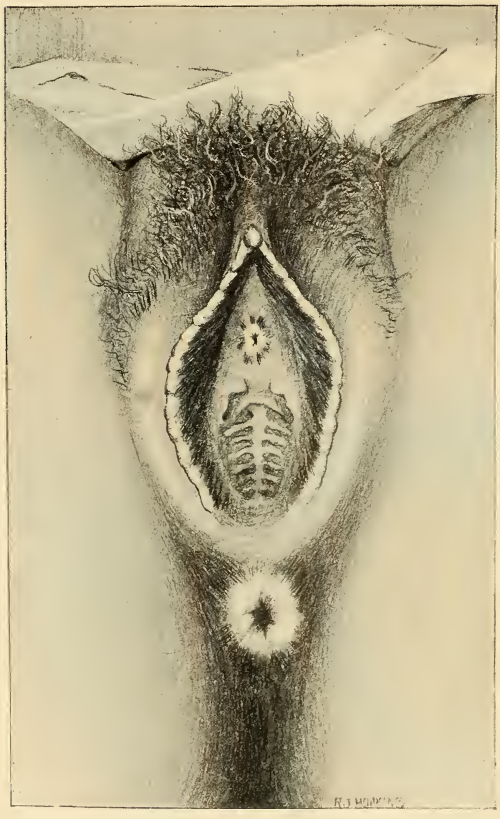

Fig. 55.—"Both halves of the vagina are imperforate."—Ballantyne.

plete menstrual retention. In Fordyce's case (*loc. cit.*) both halves opened into the urethra.

The Hymen.—This structure, which marks the dividing line between the vulva and the vagina, has been carefully studied by Schaeffer in nearly two hundred fœtuses. He found, without exception, that as early as the fifth month the hymen was composed of two lamellæ, the inner being derived from the vagina, while the outer appeared to be the inner margin of the vulvar fold; and that coalescence of these two layers was not infrequent. On the vaginal surface of the hymen were found transverse folds, similar to those in the vagina, between which were pockets so distinct that, in the event of their occlusion, they could easily be converted into retention cysts. Irregularities in the distribution of these folds account for those anomalies of the hymen which are spoken of under the names of *hymen crenulatus, dentatus, carinatus, falciformis,* etc. On the vulvar surface of the hymen in the fœtus, he found numerous folds extending from the fossa navicularis, nymphæ, clitoris, and meatus. If these observations meet with sufficient confirmation, it may be necessary to revise accepted theories of the embryologic development of this structure. At present it is looked upon as a remnant of the cloacal appendage. In the human embryos shortly after the coalescence of Müller's ducts it manifests itself by an accumulation of epithelia on the posterior wall of the rudimentary vagina. Whether it develops entirely from the vulvar side or entirely from the vaginal side, or, as is more probable, in two lamellæ, one from either side, is a matter of no practical importance. To the naked eye it presents the appearance of a mucous fold that in many instances is very elastic. The elasticity of this structure is so pronounced in a number of cases that it withstands repeated parturition. Microscopically, its surfaces are shown to be covered with flat epithelium on a network of fibrous elastic tissue, containing few or no muscular fibres. Capillary vessels and nerves are conducted by numerous papillæ from the central connective tissues into the epithelial structures.

Malformations of the Hymen

The hymen is a developmental relic, and is, therefore, very liable to variations in form and structure. It arises from the breaking down of the tissue between the sinus urogenitalis and the lower end of the Müllerian vagina, and it is possible, as Hart asserts, that the Wolffian bulbs may contribute to its formation. In addition to the well-known part of it which forms a crescentic fold at the posterior end of the vulvar aperture, the hymen consists of a mesial band running forward toward the clitoris, and forming a collar for the meatus urinarius on the way. Attention was specially drawn to this forward extension of the hymen by Pozzi (*Annales de gynécologie,* tome xxi, p. 257, 1884), and J. W. Ballantyne has described the appearances presented by the mesial vestibular band in female infants (Fig. 56) (*Transactions of the Edin-*

burgh Obstetrical Society, vol. xiii, p. 188, 1888). Anomalies may be met with in the vestibular portion as well as in the hymen commonly so-called, and even a distinct projection may exist (Fig. 57).

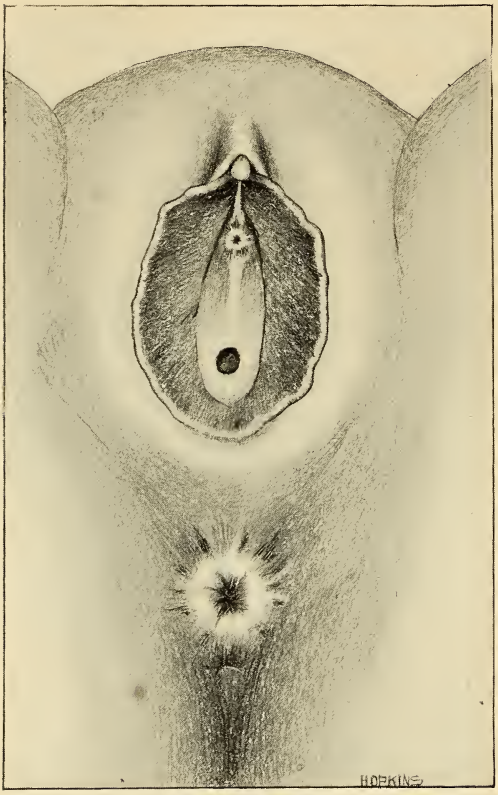

Fig. 56.—"The appearances presented by the mesial vestibular band in female infants."—Ballantyne (p. 131).

Hymenal Atresia or Imperforation.—It is extremely probable that many of the cases described as instances of imperforate hymen are really examples of atresia of the lower end of the vagina, for in some of the records the presence of a hymenal membrane hidden by the projecting vaginal sac is referred to. On the other hand, undoubted cases of atresia hymenalis do occur. The imperforate condition of the membrane gives rise to symptoms which can scarcely be distinguished from those of atresia of the lower part of the vagina. During infancy some trouble may be caused by the retention of mucus in the canal, but it is usually not till puberty that the condition attracts notice. Every month, colicky pains recur with increasing severity; there is some difficulty with micturition and defecation, which passes off in the intermenstrual period; there may be epistaxis or vicarious hemorrhage from the bladder or bowel; but there is no discharge from the genitals. Examination of the patient at one of these epochs will reveal a fluctuating tumour projecting to a larger or smaller extent above the symphysis pubis, according as the condition has been persisting for a longer or shorter time; and in the vulva will be seen a bulging membrane, which is the distended hymen. The

Fig. 57.—"Even a distinct projection may exist" (section).—Ballantyne.

condition of hematocolpus, which has been thus produced, may be accompanied by the accumulation of blood in the uterus also (hematometra). F. Neugebauer (*Medycyna*, vol. xxi, p. 429, 1893) has recorded an unusual case of hymenal imperforation without menstrual retention, the blood escaping through a small opening at the right side of the urethra; the hymen is described as consisting of two laminæ (*hymen bilamellatus*), an external incomplete and an internal complete, so that it is likely that the internal one was really the lower end of the imperforate vagina.

The first step in the treatment of hymenal imperforation consists in the evacuation of the retained menstrual blood. The membrane is incised and the fluid removed under antiseptic precautions, the latter being specially necessary if the uterus and Fallopian tubes have shared in the distention. The remnants of the hymen are then excised, and the edges are brought together with sutures. The cavity is packed with iodoform gauze. The removal of the more or less altered blood should be done slowly.

Double Hymen.—The cases in which two (or more) diaphragms exist near the vaginal outlet should not, perhaps, be regarded as instances of double hymen, but rather as examples of annular vaginal stenosis. Neither does the existence of two openings in the hymen constitute a double hymen in the strict sense of the words. The term ought to be left for the very rare instances, to which reference has already been made, in which two vulvæ exist side by side in the interfemoral region.

Absence of the Hymen.—The hymen is rarely completely wanting except in connection with absence of all the external genitals, as in some marked forms of monstrosity; but it may be apparently absent, being hidden from view by the bulging lower end of an imperforate vagina. In the newborn infant, it is folded together and projects from the vaginal orifice as two lateral folds, which may be taken for the labia minora. In the negro infant, it is deeply seated, and may in consequence be thought, on casual inspection, to be absent.

Anomalies in the Form of the Hymen.—Instead of its normal crescentic form, the hymen may be circular (Fig. 56), or notched (denticulate), or projecting (infundibuliform), or fimbriated. Instead of bounding one orifice it may show two openings, which may be equal in size and situated laterally (*hymen septus*), or unequal in size and situated irregularly (*hymen bifenestratus*); in rare cases there may be several openings (*hymen cribriformis*). J. W. Ballantyne recently met with an instance of very complete hymen septus in an unmarried woman of forty upon whom he was operating for hemorrhoids; the openings were perfectly equal in size, and the septum, which was quite fleshy, extended for some distance up the vagina; the uterus was single, as was also the upper part of the vagina.

Anomalies in the Structure of the Hymen.—The hymen, especially in elderly primiparæ, may be very tough and resistant; it may on this

account delay the dilatation of the perineum in labour; it may even prevent the consummation of marriage, and require to be excised, as in a case seen by J. W. Ballantyne (*Transactions of the Edinburgh Obstetrical Society*, vol. xiv, p. 141, 1889). If it is very vascular, as well as very tough, the laceration it undergoes in coitus may cause alarming hemorrhage.

Anomalies in the Anterior Extension of the Hymen (Urethral Hymen and Vestibular Band).—Gilliam has described two cases of what would seem to be a persistence of the anterior extension of the hymen, which surrounds the meatus urinarius like a collar. In one of these, that of a girl of eighteen, suffering from incontinence of urine, there was an anomalous band attached to the urethra and spreading itself over the muscles of the anterior aspect of the vulvo-vaginal junction; it was clipped, and the incontinence disappeared at once. In the other case, that of a girl of twenty-one, also suffering from urinary incontinence, a membrane stretched from the anterior segment of the hymen and was attached like wings to the sides and under surface of the urethra; its excision gave a cure. Gilliam (*American Journal of Obstetrics*, vol. xxxiii, p. 177, 1896) thinks that these bands set up local irritation.

CHAPTER XIV

INJURIES OF THE EXTERNAL GENITAL ORGANS

Injuries of the vulva from external violence, sexual intercourse, parturition—Pudendal hematocele—Injuries of the vagina: Rupture—Fistulæ: urethro-vaginal, vesico-vaginal—Sims's operation—Ross's operation—Reed's operation—After-treatment and dangers—Atresia of upper part of urethra—Uretero-vaginal fistulæ—Recto-vaginal fistula—Mayo Robson's operation.

Injuries of the external organs of generation may, for convenience of study, be classified into those involving (*a*) the vulva, and (*b*) the vagina. On account of the anatomical position of the vulva, which is protected above by the mons veneris and the underlying hard and resisting symphysis pubis, the descending rami, and the inner aspect of the thighs, injuries to this structure, except when due to parturition, are necessarily rare.

The vascularity of the tissues composing the vulva predisposes the structure to profuse hemorrhage, so that, should there be a solution of continuity of the skin, the loss of blood may be considerable, even amounting to syncope in weak and debilitated individuals.

In considering these injuries the anatomical construction of the surrounding and underlying parts must be borne in mind. The rami of the pubis possessing a rather sharp inner edge, a blunt instrument may be used, and yet an incised wound may be the result, the blunt object forcing the overlying soft structures against the ramus. Contused rather than incised wounds are, however, the rule.

In instances in which the skin is not divided, hemorrhage into the abundant connective tissue here found results in hematoceles of varying sizes, according to the size and number of blood vessels injured.

The *causes* of these injuries to the vulva may be considered under three headings—viz.: (*a*) External violence, (*b*) coitus, (*c*) parturition.

External Violence.—The patient may fall astride the back of a chair, as in the case of servants engaged in cleaning windows, hanging curtains, and pictures; or in the case of the female bicyclist being thrown from the saddle and alighting on the iron frame or handle bar. Ross, of Toronto, reports (*American Journal of Obstetrics*, April, 1898) a case in which a woman, while riding her wheel, was thrown from the saddle, and alighting on the sharp portion of the frame, tore the genitalia upward as high as the erectile tissue near the clitoris, producing copious hemorrhage. Hemorrhage from the vulva may be fatal even

when induced by a relatively slight injury. Ford (*New York Medical Journal*) reports a case of hemorrhage resulting in death in a patient who, while at the theatre, in attempting to change her seat, fell against the iron partition between the chairs, inducing a lacerated wound, about a third of an inch in diameter, between the clitoris and the labium minus. If the injury to the deeper structures is induced by pressure against the ramus of the pubis and does not result in severing the continuity of the skin, the resulting hemorrhage takes the form of a hematocele. (See Pudendal Hematocele.)

Among other wounds of the vulva are those produced in children while at play: A fall upon a picket fence; splinters of wood being forced into the labia while sliding upon the floor or down an incline; and falls from sleds while coasting, etc.

Injuries to the vulva by **sexual intercourse**, aside from slight lacerations of the fourchette, are of very rare occurrence, except in cases of rape of children and of women of advanced age. In the former they are due to the tender and undeveloped soft parts, and in the latter to senile atrophy and consequent want of elasticity. These lacerations generally involve the hymen in the young and the fourchette in the aged, and extend thence in various directions. Baldy reported (*American Gynecological Journal*, 1891) a case of laceration due to first intercourse, the injury beginning at the hymen and extending upward on the vaginal aspect of the perineum. Spaeth records a case (*American Journal of Obstetrics*, 1890) of laceration beginning at the vulvar orifice, extending upward along the posterior wall of the vagina, causing a vesico-rectal fistula.

Parturition is by far the most frequent cause of injuries to the pudenda. (See Pudendal Hematocele.) Here also the perineum suffers the greatest injury. Contusions of the labia, and sometimes of the vulvo-vaginal glands, are due, in the majority of instances, to a failure of the head to rotate into the conjugate diameter of the outlet of the pelvis. Not infrequently also does the careless use of the forceps cause lacerations and contusions of these parts.

Treatment.—The treatment of injuries of the pudenda does not differ greatly from that of like injuries inflicted elsewhere. The parts should be well shaven, washed, and antisepticized, and lacerations and incisions sewn up. If contusions only are to be dealt with, the carbolic pack is applied. This dressing is prepared in the following manner: Flakes of absorbent cotton are first saturated with a 1- or 2-per-cent solution of carbolic acid, then squeezed out almost dry and applied to the antisepticized injured part. Over this are applied flakes of dry cotton, and the whole is covered with rubber tissue or oil silk. The dressing is held in place by a properly adjusted T-bandage. A dressing thus applied will last from six to ten hours. Further treatment is given in the section relating to Pudendal Hematocele.

Pudendal hematocele may be the result of a blow, a kick, or a fall; or, in the pregnant state, of varices preceding labour, the

pressure of the descending head, or the unskilful use of forceps. M. A. Tate, of Cincinnati, who has conducted a painstaking research on this subject (*Lancet-Clinic*, October 17, 1896), finds that it was first mentioned by Rueff, of Zurich, in 1647; in 1734 by Kronauer, of Basle; and again, a hundred years later, by Deneaux, from which date (1830) reports of cases have been relatively more frequent. When it occurs, from whatever cause, the clot generally forms in one labium, although in certain cases its progressive accumulation results in separating the connective tissue of practically the entire pudendum. The tumour thus formed may therefore vary in size from very small to very large, Cazeaux reporting one case in which the extravasation was so extensive that it ploughed up the abdominal wall of the right side to the costal margin. Occasionally the rupture occurs in the wall of the vagina, and only reaches the vulva by an extension of the accumulation, while in other cases the hematoma is confined to the vaginal wall. Sometimes, the distention becomes so great that the skin or mucous membrane gives way and the blood clot escapes. If the hematocele is the result of rupture of an artery, the hemorrhage resulting from the breaking down of the skin may become active, even after the clot has been *in situ* for a number of days. In small accumulations the clot may be absorbed; in others, where the pressure of the integument is very great, or where the contusion has been extensive and severe, gangrene may result. In occasional cases the clot may become solidified, even to the extent of calcification. The symptoms of pudendal hematocele consist of swelling of the labia, with pain in the parts, which, even in the midst of the pains of labour, is generally sufficiently severe to attract the attention of the patient. The tumour increases rapidly in size and at first is usually without any change of colour in the skin, but later becomes pinkish and bluish, and finally, when absorption is well under way, it becomes brown or bronzed in appearance. This tumour is generally at first very tense, but later, as absorption or suppuration takes place, becomes softer and more fluctuating. Its formation may be attended with some shock, corresponding in degree to the severity of the causative injury or the amount of the extravasated blood. The rarity of this complication of labour, says Sasonoff (*Archives de gynécologie*, November, 1884), will be appreciated when it is remembered that Winckel noted only one case out of 1,600 confinements; Hecker, two cases out of 17,200; Spiegelberg, three out of 3,000; and that, at the St. Petersburg Maternity, there have occurred only eight cases out of 19,396 labours. Generally, then, it may be said that this complication occurs but once in 2,375 labours. The prognosis of these cases, so far as life is concerned, is favourable, and hematocele is rarely, if ever, fatal from the loss of blood, unless there is secondary rupture, when the subcutaneous extravasation becomes converted into a free hemorrhage. These injuries, however, are in many instances associated with enough superficial destruction of tissue to serve as an infection atrium, with the result that the underlying clot is

very liable in the course of the next few days to become converted into a culture medium for the propagation of pyogenic bacteria. As a complication of labour, pudendal hematocele is looked upon by both Playfair and Cazeaux as very serious. Tate (*loc. cit.*) has collected cases of pudendal hematocele occurring as a complication of labour as follows:

	Cases.	Fatal.
Playfair (collected by various French authors)..	124	44
Scanzoni..	15	1
Deneaux	62	22
Barker	22	3
Blot	19	5
Winckel	50	6
Total	292	81

It must be remembered, however, that in explaining the mortality of 81 in a total of 292 cases from an accident intrinsically so controllable as pudendal hematocele, an important percentage of these cases occurred before the inauguration of the present antiseptic *régime*. It is true that of these cases, but three, those reported by Barker, were recorded as having died from sepsis; but this fact does not exclude the extreme possibility that an important number of the remaining deaths occurred from the same cause.

The *treatment* should vary a little according as the hematocele is the result of external violence or of parturition, and according to the size of the clot. If external violence is the cause, and if the clot is large, and has developed, or is developing, with rapidity, there is strong probability that it is being fed by a severed artery, under which circumstances the patient should be anæsthetized and the bleeding points found and ligated. If, however, the clot has formed slowly, and is not large, it should be treated with rest and the application of ice bags. If, after a few days, the tumour becomes red about its circumference and the pain, of a pulsating character, shows a tendency to increase, and if there is some elevation of temperature, the clot may be considered to be the seat of incipient suppuration and should be freely incised, its cavity thoroughly cleansed, first with the hydrogen peroxide, and next with a 1-to-2,000 mercuric bichloride solution.

If a hematocele occurs as a complication of labour, rather more chances should be taken to secure its absorption; as a free incision in the presence of the probably contaminated lochia may be far from an innocent procedure. It should be remembered that there exists the reciprocal danger of liberating into the vagina, or, at least, about its orifice, pathogenic bacteria that have developed in the pus of a suppurating hematocele. A pudendal hematocele in a parturient case should, therefore, be opened only in the presence of the most positive indications, after which its treatment should be conducted on lines of the most rigorous and persistent antisepsis.

Injuries to the external genital organs due to parturition, aside from pudendal hematocele which has just been considered, occur in (*a*) the perineum (see Pelvic Floor and its Injuries), and (*b*) the vagina. Of the injuries to the vagina, the chief ones are rupture and fistulæ.

Injuries of the Vagina.—Rupture may occur at any place, although it is more common in the posterior than in the anterior wall. Such lacerations have occurred through the vault of the vagina into Douglas's cul-de-sac and through the recto-vaginal septum. They have occurred also in the fornices, splitting up the broad ligament and causing dangerous hemorrhage, by severing the important blood vessels that lie upon either side of the vaginal tract. When these lacerations occur, they should be immediately cleansed, and the usually contused and roughly lacerated margins of the wound pared off and approximated by interrupted nonabsorbent sutures. Many of these lacerations pass without recognition and heal spontaneously by the formation of irregular cicatrices which narrow the vagina in an irregular way, causing dyspareunia and other distressing symptoms.

Rupture of the vagina is to be looked upon as a tear due to the joint influence of an expansive force and to the inelasticity of the canal. It may result in the formation of a fistula, but a rupture is to be distinguished from a fistula in the particular, that while a tear is caused as already indicated, fistula is generally the result of prolonged pressure and subsequent necrotic changes.

Fistulæ.—A fistula is an unnatural channel that leads from a cutaneous or a mucous surface to another free surface, or that terminates blindly in the substance of an organ or part. The edges of such openings are covered with epithelium. The forms of fistula that are met with in the female genital tract are urinary and fæcal.

Urinary Fistulæ.	*Fæcal Fistulæ.*
Urethro-vaginal.	Recto-perineal.
Vesico-vaginal.	Recto-vaginal.
Vesico-uterine.	Entero-vaginal.
Uretero-vaginal.	
Uretero-uterine.	

Urinary Fistulæ (*Urethro-vaginal, Vesico-vaginal*).—The variety most commonly met with is the *vesico-vaginal* (Fig. 58). It sometimes happens that a fistula exists between the bladder and the vagina, and, at the same time, that the urethra has been partially or totally destroyed. A vesico-vaginal fistula may vary very much in size. At times it is so large that the mucous membrane of the bladder prolapses through it and the bladder is almost turned inside out. The mucous membrane is easily recognised by its bright-red colour. At other times the fistula is only large enough to admit a small probe. The nearer to the time at which the fistula was caused, the larger is the opening. The openings that are at first large gradually contract and

close. It is then difficult to say how large the opening may have been originally. The cicatrix that is formed is generally thin and firm. When the urine discharges freely from the bladder after the formation of a fistula, contraction of the bladder, with thickening of its walls,

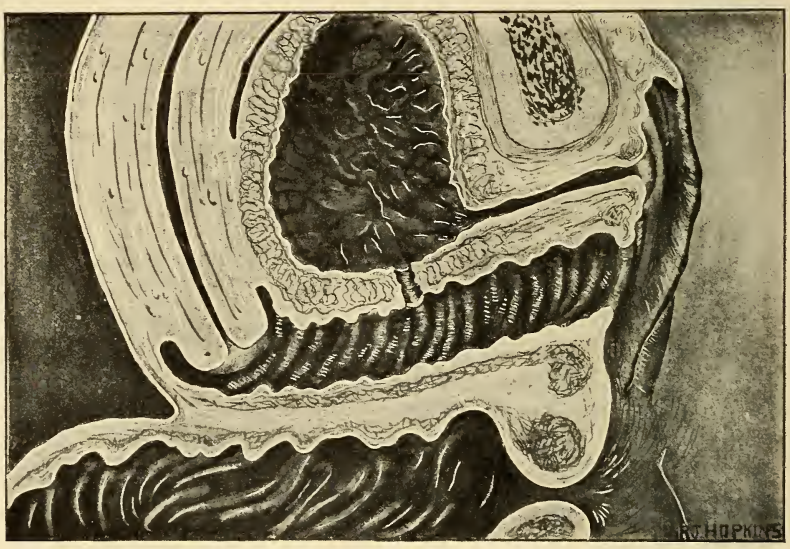

Fig. 58.—"The variety most commonly met with is the vesico-vaginal."—Reed (p. 139).

ensues. The urethra may be contracted on account of its inactivity. The vagina around the edges of a fistula is sometimes firmly fixed to the bone. In this way the edges of the fistula are drawn apart. *Vesico-uterine fistulæ* are rare. They can only be recognised after the uterine canal has been opened up. *Uretero-vaginal fistulæ* are situated in the fornix vaginæ. They are small and admit only of the entrance of the point of a sound. They open at the point of a small papilla or else have very sharp edges.

The *etiology* of urinary fistulæ in general must take into account the element of pressure, the duration of which, rather than the intensity, determines the injury. Sometimes the surgeon produces a fistulous opening for the relief of chronic cystitis, or for the removal of a stone from the bladder, or the bladder may be accidentally wounded during the performance of the operation of hysterectomy. Ulcerations of the bladder may occasionally produce perforation of the septum, and are sometimes a consequence of the presence of a vesical calculus. A pelvic abscess may open in such a way as to give rise to a urinary fistula, which may be induced also by foreign bodies, such as the long-continued use of a pessary in the vagina. Injury received during labour is generally looked upon as the most frequent cause of these fistulous openings. Such a condition may be produced by a tear through the septum, or, as is most commonly the case, a necrosis is produced by pressure dur-

ing tedious delivery. Whatever may cause a difficult labour, may, therefore cause a fistulous opening between the urinary and the genital tracts. It is not necessary to dwell upon these conditions, as they are well known. Cuts that will give rise to fistulous openings may occasionally be produced by the use of instruments in accomplishing delivery. Such cuts usually occur in the lower part of the vagina. The forceps is no doubt more frequently blamed for the production of fistulous openings than it should be. It is generally used in difficult labours; that is to say, those in which there is long-continued pressure on the soft parts. We may conclude, therefore, that the fistulous openings are due to the long-continued pressure in such cases and not to the use of the forceps. They may be due to the nonapplication of the forceps. Fistulous openings have been produced, sometimes, as a consequence of cuts made by splinters of fœtal bones during the performance of the operation of craniotomy. Malignant disease frequently causes fistulous openings, not only into the bladder, but also into the rectum. Nothing can be done by surgical means to alleviate the sufferings of these poor unfortunates, and such cases need not be considered here. A calculus is frequently formed in the vagina as a consequence of the presence of a vesico-vaginal fistula.

The *symptoms* of urinary fistulæ in general demand careful consideration. When a patient complains of an involuntary flow of urine, an examination should always be instituted, to ascertain the reason why such an abnormal condition exists. After labour, the patient may be discharging the urine naturally, or she may be unable to pass it, and it may be retained in the bladder, and yet, within a few days, there may be an involuntary flow of urine due to the presence of a vesico-vaginal or one of the other forms of urinary fistulæ. The pressure at the time of labour produces the necrosis, and the formation of the opening is delayed for several days until the slough separates. If the opening is caused by a tear, urine will flow at once *per vaginam*.

The symptoms vary according to the situation of the fistulous opening. When situated high up, the bladder fills up to the level of the fistula, if the patient is in the erect posture, and there is no leak until the urine reaches so high as to overflow. When there is a urethro-vaginal fistula, the bladder may be able to hold the urine, and yet the urine will not come out through the normal opening. The patient's clothing in these cases is not kept wet. The odour produced from the urine becomes unpleasant to the patient and friends; the skin of the adjacent parts becomes excoriated, red, and irritated. Sterility is usually produced, although there have been cases of conception recorded. The patient feels disagreeable to herself and to others. The general health frequently becomes considerably impaired, and the patient is always ready to submit to operation if any promise of relief can be given.

The *diagnosis* must be made between these fistulæ and certain conditions of the bladder that allow the escape of urine. One of these

conditions is a paralysis of the sphincter vesicæ muscle, due, frequently, to difficult labour, and rendering the patient unable to hold her water. It may remain in the bladder while the patient lies in the recumbent posture at night, but when she rises to the erect posture it comes away and wets her clothing. The irritated appearance of the genitals, and the characteristic odour, indicate that there is a fistula. To be satisfied of this, it is a good plan to inject sterilized milk, or a coloured nonirritating fluid, into the bladder. Any fluid escaping from the bladder can then be more readily detected on account of its colour. This method is one of the best in vogue. Sometimes the opening can readily be detected with the finger. When the milk is being used, it is better to have the patient turned on her left side with the Sims speculum in position. All discharge must be wiped away from the vagina in order that the field to be inspected may be in a cleanly condition. As the bladder is distended, we must carefully watch the anterior vaginal wall for any oozing of the stained fluid. If no fluid comes away, we must infer that the opening is below the sphincter, or that no opening exists. If no special leak occurs during the act of micturition, we must then conclude that the leakage of urine is not due to the presence of a urinary fistula, but is due to some other cause.

In considering the *prognosis*, it is well to bear in mind that small fistulæ sometimes heal without any surgical intervention. Many of the small fistulæ, however, and all of the large ones, require operative treatment. The prognosis is not so favourable for cases in which the connective tissue of the urethro-vaginal and vesico-vaginal fold is bound down to the bony parts in the neighbourhood. If this condition is present, it is difficult to approximate the edges without great tension being placed upon the stitches.

Treatment.—Recently formed fistulous openings have a tendency to close. This tendency is one of the difficulties met with in attempting to keep up free drainage from the bladder by means of an artificially produced vesico-vaginal fistula for the treatment of chronic cystitis. Such fistulous openings will often close if they are kept clean and anointed with a little vaseline or zinc ointment, and if the bladder is kept washed with boric acid or sodium biborate (5j to Oj) solution, to remove the incrustations that are liable to form at the edges of the fistula. *Operations* on such cases are difficult. We must be able to reach the fistulous openings, and we must be able, when we have reached them, to bring the edges carefully together with sutures. There are two positions in which the field of operation may be brought into view. One is the position on the left side with the Sims speculum, and the other position is that in which the patient is placed on the abdomen with the knees hanging over the end of a structure raised up in the centre of an operating table. To use the latter position, Ross proceeds as follows: The head of the patient should be lower than the buttocks, and therefore different-sized boxes should be used, carefully padded and

covered with pillows, placed upon the operating table, unless one is fortunate enough to obtain the use of a Bozeman's table. The patient's head is made comfortable, her arms are allowed to hang down on either side, parts under the chest and abdomen are carefully padded, a pillow is inserted under the crests of the ilium where they impinge upon the newly constructed platform, and great care is taken to see that the knees do not touch the table below. If the knees are allowed to press for any considerable time on the table while the patient is under an anæsthetic, sloughs may be produced that will be very tedious to heal. A rubber sheet is placed in such a way that the water that is being used in a constant stream from the "douche can" or "bag" is conducted to a foot bath at the end of the table. An assistant then stands on one side of the patient and holds the Sims speculum, or some modification of the same, in position on the posterior vaginal wall. The operator may use the German water speculum for this purpose. It is not easy for the anæsthetist to give the anæsthetic while the patient is in this position unless the pillows are properly arranged.

Sims pared the edges of the fistula in such a way as to avoid the mucous membrane of the bladder. He brought together the edges of the fistula with silver wire, without allowing the stitches to penetrate the mucous membrane. Other operators have not done this, but have cut directly through, paring all tissues evenly, and bringing the edges evenly together with sutures passing through the mucous membrane, as well as through the vesico-vaginal tissues. Others use the flap-splitting method in order that they may be able to make use of the larger wound surface thus produced in the healing process. Any of the three methods will answer if certain important details are carried out. The approximation must be exact and thorough; the stitches must be inserted far enough away from the edges to enable them to give the proper amount of support; precautions must be taken to prevent any contamination of the wound by urine, or other septic material, and healing by first intention must, if possible, be procured.

Each case must be individually considered. If the rules that are well-known to govern the healing process in this locality are adhered to, success will follow; if these rules are not adhered to, success will not follow the operation, no matter which operator's method is employed. In every case of vesico-vaginal fistula it is advisable to examine for vesical calculus before closing the fistula.

It is not wise to operate at too early a period after the formation of the fistula. The tissues must be allowed to contract to their utmost extent and to regain their natural condition after the softening that is produced as a result of pregnancy has disappeared. Unless this is done, they are too friable and too easily torn to stand the strain of stitches. It is not wise to attempt to operate for at least eight weeks after confinement, nor is it wise to do a second operation until at least a month or six weeks have elapsed since the first was performed. A preparatory treatment has been advocated by some for the purpose

of loosening cicatricial bands. This may be necessary. Incisions can be made and tissues loosened, and these incisions allowed to unite before any fresh ones are made. We may thus gain considerable room.

Frequent vaginal injections are not necessary in all cases, in order to bring the edges into good condition. Any irritation that is present in the vagina may be relieved by the use of pessaries made of fifteen grains of oxide of zinc to a hundred and twenty grains of cacao butter, introduced into the vagina once or twice a day. It is wise to heal up ulcerations about the buttock.

Sims's Operation.—The bowels having been thoroughly evacuated by a cathartic and the rectum having been washed out by an enema immediately before the operation, the patient, having been shaved and sterilized, is placed upon a table on her left side in the Sims position (Fig. 2). The Sims duck-bill speculum is introduced into the vagina and intrusted to an assistant, who is instructed to hold it with considerable attention, exerting the force in an upward and forward direction. The fistula will then be brought to view. It should at this point be inspected carefully to determine its natural lines and the consequent direction in which the lips will be approximated. Having determined this point, the margin of the fistula is seized with a volsella or long hemostatic forceps and the continuous strip of cicatricial tissue is cut away from the margin of the fistula along its entire circumference, care being taken to avoid the vesical mucosa. The small amount of blood that oozes from this surface should now be carefully wiped away and the surface inspected. If at any point the surface is not deemed broad enough for the purpose of approximation and union, a little more tissue may be removed. Simon, who was very successful in dealing with this accident, included the vesical mucous membrane in the denudation; but Emmet avoided doing so on the ground that it caused unnecessary and often embarrassing hemorrhage. He alludes to a case in the practice of Peaslee in which the patient died from hemorrhage of this character. In some cases in which the vaginal wall was made too thin, it was the practice of Sims, Emmet, Bozeman, and the early operators in this field, to carry the denudation to the vaginal surface; or, if this was impracticable, to split the margins of the flap. It was in this incidental practice that these early operators gave recognition to an important principle of procedure, which many years later was published by Lawson Tait and adopted by his followers. The margins of the fistula having been thus incised, a short, strong, slightly curved needle, loaded with a double loop of silk thread and carrying silver wire, is passed through one lip of the fistula, and brought over and out through the other lip at a directly opposite point. One after another of these sutures is passed at intervals of from an eighth to three sixteenths of an inch apart. When the silver wires are all *in situ*, the margins are again washed carefully and the sutures, one after another, are closed by simply bringing the opposite ends together and twisting them. Great care should be exercised in this manipulation, as by overdoing it the

entire operation may be easily defeated. It is important to cross the wires first and ascertain exactly the point at which they will cross. Each end should be bent by a sharp angle at that point, crossing and twisting thence outward. If they are crossed without any regard to this precaution, the twisting will extend toward the field of operation and toward the distal layer of the wall. In this way a destructive tension will be brought to bear upon the tissues, the wire will cut out before union is completed, and the objects of the operation will be defeated. Silkworm gut may be employed as a suture material, although it is probable that if the technique of Sims is to be followed, it would be better to follow it in its entirety. The operation thus concluded, the vagina is again thoroughly irrigated and a little gauze is inserted. The sigmoid catheter with several feet of small drainage tubing attached is inserted into the urethra and the patient is put to bed.

Ross's Operation.—The *instruments* required for the operation are as follows:

Sims's speculum, or some modification of Sims's, such as Simon's, Fritsch's, the self-retaining, or the German water speculum.
Retractors or spatulæ.
Three or four single-toothed, double-bladed tenacula.
Douche can and tube.
Pressure forceps.
Long-handled dissecting forceps.
Several other long-handled tissue forceps.
Small bistouries, or a set of Sims's vesico-vaginal fistula blades.
Angular-curved and flat-curved scissors.
Small sponges or wipes.
Sponge holder.
Curved needles, short, but curved almost into an oval instead of into a circle, with cutting sides.
Needle holder.
Silver wire, best quality.
Catgut.
Silkworm gut.
Wire twister.
Blunt hook.
Large-sized male sound.

In a good light, with the patient in a position on the face and properly placed, the operator standing up to his work, the water speculum holding the posterior vaginal wall and allowing water to constantly trickle over the fistulous opening, this operation is rendered an easy one. It may be performed without an anæsthetic and with perfect success. It is the getting at the part that is the most difficult portion of the operation. After the parts have been reached by sight and by touch it is then an easy matter to pass the sutures.

Any sponges that may be used must be small. If a current of water is allowed to trickle continuously, it is scarcely necessary to use sponges. When we are ready to pare the wound, a tenaculum should grasp each side of the fistulous opening, taking in all the structures. The tenaculum should be one that will lock, so that it can hang in position without requiring the attention of a hand. A sound is passed into the bladder to push out the wall during the paring of the edges of the fistula. Then, either a knife is passed directly through the edges of the wound, in order that a portion may be completely pared off, or a pair of

sharp-pointed scissors is inserted and is run round the edges as the first step in the flap-splitting process. Some operators cut down on the vaginal side away from the edge of the fistula, as far as halfway through the thickness of the vesico-vaginal septum, and then turn in toward the bladder the two flaps thus removed, so that the bladder contains a small portion of vaginal mucous membrane lined with squamous epithelium. The outside raw surface is then drawn together by sutures. Hemorrhage should be checked by means of the hot douche. Any large bleeding points found should be compressed with pressure forceps. This should be done before the edges are brought together, though it is not wise to lose much time if general oozing continues, as the pressure of the sutures will usually stop this. The greatest amount of oozing usually takes place from the congested mucous membrane lining the bladder. The edges must now be carefully adapted with sutures. When the sutures are passed, great care must be taken not to include much, if any, of the mucous membrane of the bladder. A blunt hook is used to make counter pressure during the introduction of the sutures. It is not very frequently needed. The sutures should be passed close enough together to afford ample support.

If silver sutures are used, iodoform gauze should be inserted into the vagina, to prevent the suture ends from irritating the posterior vaginal wall. Care must be taken, in removing this gauze, not to use any force that is liable to disturb the stitches, should a portion of it become entangled in the meshes of the wire.

With reference to the original operation of Sims, there are several points that are open to criticism, notwithstanding the fact that he and his immediate followers achieved great success in their operations upon this class of cases. The experience of the profession, however, has demonstrated that a modification of the technique will result in greater facility of operation, and in at least equally satisfactory results. Thus the Sims operation requires the presence of an assistant to hold the speculum. When the perineum is retracted and the atmospheric pressure is exercised upon the anterior vaginal wall, the fistula drops inward and forward—the farthest possible distance away from the operator. It is necessary for him, therefore, to employ long-shanked instruments to conduct his operation. The method of denudation is one which necessarily sacrifices a greater or lesser amount of tissue from a locality where too much tissue has already been destroyed. In the event of successive operations by this method, the hope of a successful issue is ultimately destroyed by the sacrifice of the septum. Reed remembers to have seen a case in the Rotunda Hospital, in Dublin, in which the entire base of the bladder had been whittled away in successive efforts to close an originally large fistula. As an example of what some operators recognise as an easier and equally effective technique the following is given:

Reed's Operation.—The patient is prepared precisely as indicated in the preceding paragraphs. She is placed on the table on her back,

with her knees drawn well up, and retained in that position. Mechanical devices are better, however, as injury to the hip joint has been done by the unguarded action of assistants in exercising too much pressure upon the legs. A Jones's self-retaining speculum is now inserted, by which means the fistula is brought directly into view. The line of closure having been determined, an incision is made outward from either angle, extending through the mucous membrane of the vagina. The margin of the fistula is now split, either by means of the knife or a pair of sharp-pointed scissors curved on the flat, and one blade inserted through the incision already made beneath the mucous membrane, and carried around to the incision in the opposite angle (Fig. 59). The other lip of the fistula is treated in the same way. The mucous membrane of the vagina and of the bladder are by this means separated into two flaps; those in the bladder can be folded inward and approximated, while those within the vagina can be folded outward and similarly approximated. A curved needle mounted on a handle and specially devised for the purpose, is now inserted just beneath the vaginal mucous membrane, made to dip deeply into the cellular layer, and brought out just beneath the vesical mucosa. It is then crossed over and inserted beneath the vesical mucosa; dipped deeply into the cellular layer, and brought out just beneath the vaginal mucosa. It is then threaded with silkworm gut and withdrawn. Other sutures passed in a similar way at intervals of less than a quarter of an inch (Fig. 60) are then drawn together and tied. In this way, the approximation surfaces are increased in area (Fig. 61) while by the old through-and-

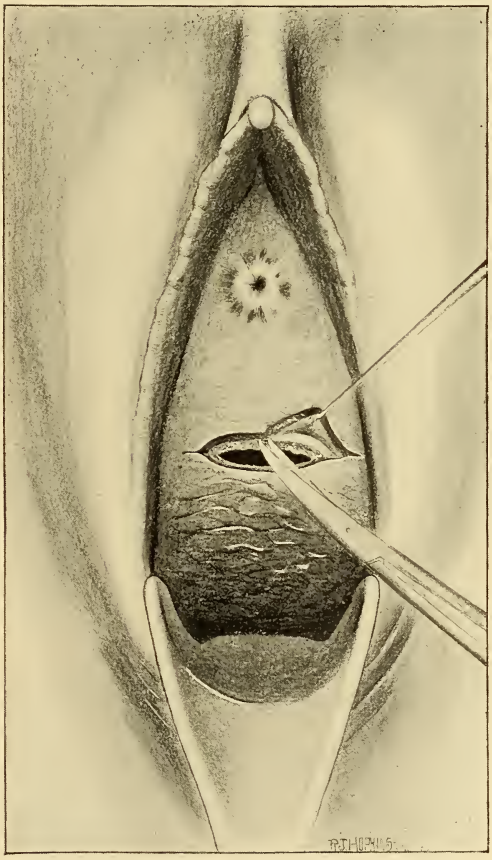

Fig. 59.—"The margin of the fistula is now split."—Reed.

through sutures they are diminished in area (Fig. 62). The sutures are removed on the eighth or tenth day. The buried suture may be employed somewhat after the manner introduced by Martin, of Berlin. After the denudation has been made, just as in the operation by means of the interrupted suture, formalinized catgut is inserted so as to include all of the cellular structure between the two mucous layers. A continuous suture is employed for this purpose, involving the cellular tissue, but not passing through either mucous layer (Fig. 63), as generally tied, and the superficial intermucous suture is then adjusted. The advantage of this form of closure is that the approximation is very effective and no trouble arises from the removal of sutures.

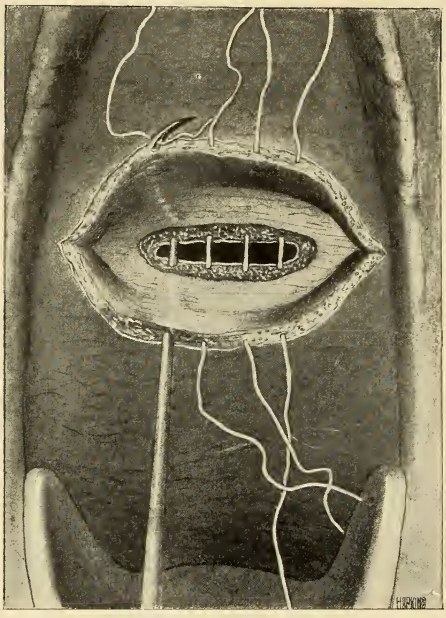

Fig. 60.—"Other sutures are passed in a similar way at intervals of less than a quarter of an inch."—Reed (page 147).

After-treatment.—Some operators do not use the semiprone position and the self-retaining catheter after operation; but this treatment is the best that can be pursued and is adopted by many.

If it is intended to place a catheter in the bladder the best form to use is Skene's modification of Bozeman's self-retaining hard-rubber catheter. There is another form of winged soft-rubber catheter that can be used. The urine is then collected in a vessel placed in bed. The catheter should be changed every day, as the salts of the urine are deposited on the perforations, and in this way the instrument is very soon blocked up. The instrument also requires cleansing, but it

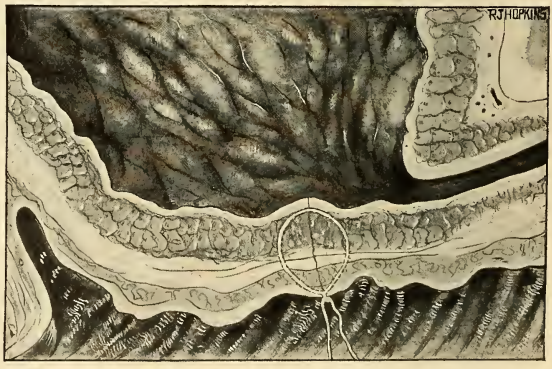

Fig. 61.—"In this way the approximation surfaces are increased in area."—Reed (page 147).

can be replaced in the bladder a few minutes after its removal. It is better to have two catheters, so that when one is removed for the purpose of cleansing, the other can be placed in position. The nurses must be vigilant, and immediately report any plugging of the catheter to the proper authority. Some prefer to use the catheter for two or three days only, and then to have the urine drawn every three hours. Tsokana, of Athens, Greece, reports, in a communication to the editor, that he closes the fistula with interrupted silkworm gut sutures, tied by a single knot with an extra whirl, and permits his patients to get up and go about shortly after the operation is completed. His results are satisfactory, as he claims that the upright posture favours the natural drainage of the bladder and the retention of the parts in a state of approximation.

Fig. 62.—"By the old through-and-through sutures the approximation surfaces are diminished in area."—Reed.

The *after-dangers* of the operation are irritation and inflammation of, and hemorrhage into, the bladder. When blood clots collect they

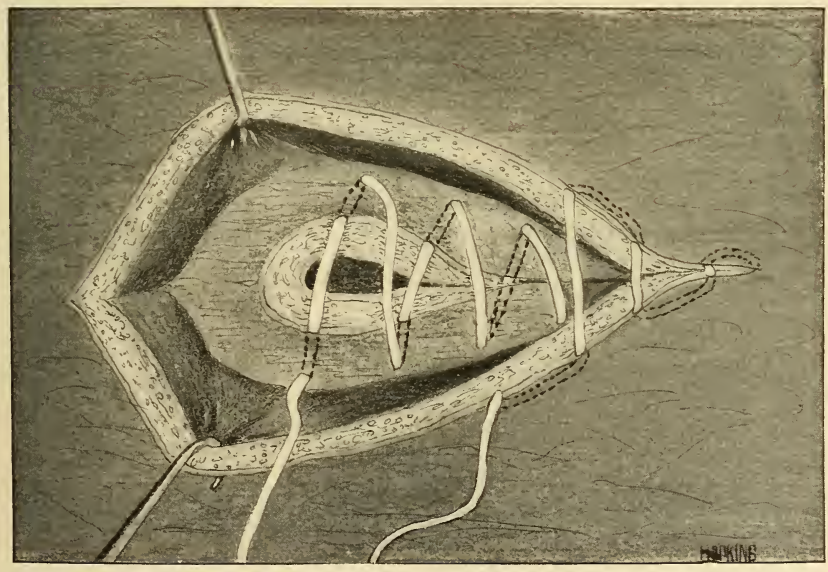

Fig. 63.—"A continuous suture is employed for this purpose, involving the cellular tissue, but not passing through either mucous layer."—Reed.

are troublesome. If the hemorrhage is severe, the fistulous opening must be reopened. This should not be necessary if proper attention to details is given at the time of operation. It is always possible

that a hemorrhage may occur, subsequently to operation, in a patient prone to bleed, but all excessive hemorrhage should be checked at the time of operation before the stitches have been finally tied. If secondary hemorrhage occurs from the third to the fifth day, a vaginal tampon may relieve it. The ureter has been caught in a stitch on more than one occasion. If the patient suffers from intense pain in the neighbourhood of the kidney after the performance of this operation, one should suspect that some such unfortunate occurrence has taken place. Symptoms of uremic poisoning may set in as a consequence of this accident. The *sutures* are usually removed from the seventh to the tenth day. Great care must be taken in removing these sutures. If silver wire is used, the portion of the loop away from the knot should be bent outward, so that the loop then has about the curve of one of the needles used in placing the sutures. Counter pressure should be placed over the parts while the stitches are being withdrawn. Sutures must be counted and must be all removed, because a loop of wire left behind may afterward become the nucleus of a vesical calculus. The *catheters* placed in the bladder should be kept *in situ*, except when they are removed for cleansing purposes, until the operator feels satisfied that the patient can pass water voluntarily without breaking down the wound. This will depend, to a great extent, upon the appearance of the wound. In some cases, it is possible to let the patient void urine earlier than in others. The smaller the fistulous opening, the earlier the patient may be allowed to void urine; the larger the opening, the longer this act should be delayed. If there is no great amount of visceral irritation, Ross leaves the self-retaining catheter *in situ* until after the stitches have been removed, and keeps the patient turned on her face for at least a week after the performance of the operation.

When the operation has not been an entire success, a second, a third, or even a fourth must be performed. At each operation a portion of the fistulous opening closes and the fistula becomes smaller. One must not be discouraged. Each operation should bring us nearer the long-looked-for goal.

It sometimes happens after these operations that, when the fistulous opening is closed, the patient continues to lose urine involuntarily and does not believe in her recovery. In such cases there has been a loss of tone in the sphincter vesicæ muscle, but in others the parts gradually regain their tone.

Atresia of the Upper Part of the Urethra is sometimes found in cases in which a vesico-vaginal fistula exists. It will then be necessary to make a new opening, and to keep it open by the use of sounds, unless the operator feels disposed to cut out a portion of the urethra and unite the neck of the bladder to the portion of the urethra below the excision. If atresia exists between a urethral fistula below and a vesico-vaginal fistula above, the readiest way to deal with it is to thoroughly loosen up the tissues and bring the upper edge of the vesical fistula down to the outer edge of the urethral fistula. To unite such a fistula, however, a

combination of the transverse and longitudinal operation may be done. A transverse incision may be made by making an artificial vesico-vaginal fistula just above the neck of the bladder. The upper edge of this can then be stitched to the lower edge of the urethral fistula, and, after healing has taken place, the edges of the original vesico-vaginal fistula can be closed by stitches placed so as to bring the edges together from side to side, leaving a longitudinal scar.

Uretero-vaginal Fistula.—A fistula may readily be formed between the ureter and the uterus, or between the ureter and the vagina. Such fistulæ are fortunately rarely met with. They are very difficult to deal with and at times somewhat difficult to discover. These fistulæ can be most readily discovered by means of a probe. If the probe passes on farther than the confines of the bladder would indicate, it must be disappearing into the ureter toward the kidney on that side. We can make out the perviousness of the lower portion of the ureter by introducing a probe in the other direction toward the bladder.

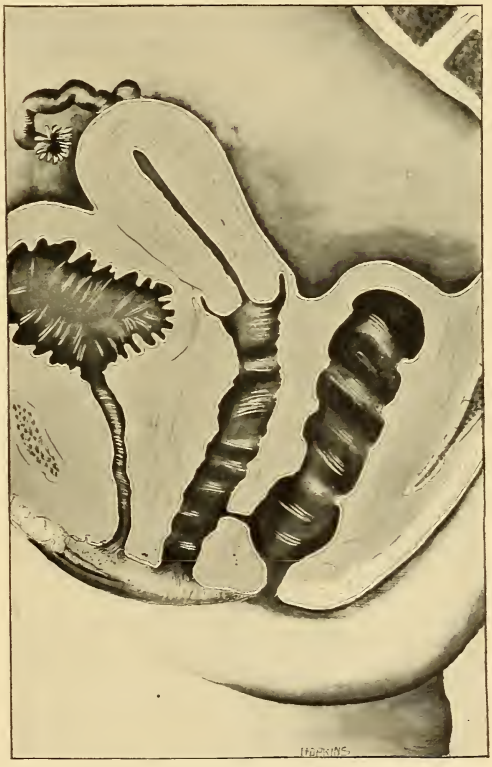

Fig. 64.—"Recto-vaginal fistula."—Mayo Robson (p. 152).

Treatment. — Nephrectomy may be considered but should only be carried out as a last resource. If the fistula can be closed by a direct method of operation, this should be carried out. If it can not be closed, we must then contemplate implantation of the ureter in the bladder.

To effect *closure of the fistula,* an incision may be made down over the ureter and a catheter passed into the bladder, and out through an artificial opening made in the bladder wall just below the ureteral fistula. The catheter can then be carried on up into the ureter and the tissues around closed by silver-wire sutures. Another catheter may be placed in the bladder alongside of this one in order that it may be kept empty. The flap-splitting method may be here applied, as in vesico-vaginal fistula operations. (For the operation of implantation of the ureter in the bladder see Uretero-cystostomy.)

Recto-vaginal Fistula.—Recto-vaginal fistula is by far the most frequent of the fistulæ between the intestinal and vaginal tracts, and may occur at any part of the posterior vaginal wall (Fig. 64). It is a peculiarly distressing ailment, not only because of fæces escaping by the vagina, but from the fact that intestinal gases pass into the vagina and escape with an audible bubbling or hissing noise; and the odour being perceptible to the sufferer, she broods over her condition, secludes herself from society, and usually passes a miserable existence, which may end in melancholia.

Causes.—Cancer, syphilis (see Malignant Neoplasms of the Vagina; also Syphilis), and injury are the usual causes. Pyosalpinx and other inflammatory diseases of the appendages not infrequently cause fistulæ, but these are usually rectal or vaginal, seldom recto-vaginal.

Fistula from Traumatism.—Recto-vaginal fistula may occur from the ulceration induced by the long-continued presence of a pessary, from the presence of some foreign body in the vagina or rectum, or from a stab wound accidental or intentional. In these cases, the fistula usually heals on removal of the cause, together with careful attention to the wound by mild antiseptic douches and gauze packing.

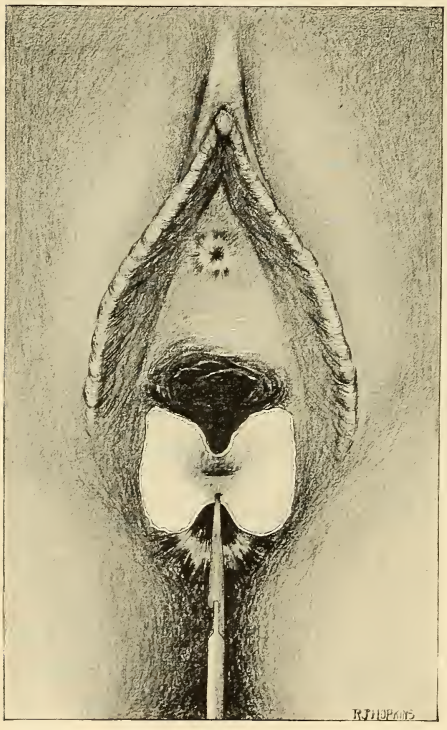

Fig. 65.—"Lay the whole fistula open by cutting through the tissues intervening between it and the surface."—Mayo Robson (page 154).

Sometimes, stretching the sphincter so as to temporarily paralyze it gives rest to the parts and assists the healing process.

Injuries occurring in childbirth leading to recto-vaginal fistula are not so infrequent as modern obstetric treatment might lead one to suppose. They not infrequently follow complete rupture of the perineum, where the rent has passed well up the recto-vaginal septum, and where the primary operation has led to healing of the perineum and perhaps of the sphincter, but where there has been a failure in union of the rectal wound.

These fistulæ may occur at any part on the posterior wall of the rectum, from just within the sphincter up to the highest point the finger

can reach, and may vary in size from an opening admitting a No. 1 catheter to a slit admitting one, two, or three fingers.

They may also follow on sloughing caused by pressure from delayed delivery, but from this cause recto-vaginal is much less common than vesico-vaginal fistula.

Small fistulæ will occasionally heal spontaneously; others require surgical intervention. If the fistula is situated high up in the vaginal canal and fails to close under cleanliness and general attention to the bowels, a plastic operation will be advisable.

The bowels should be well cleared by aperients given for three or four days before operation, and during this time the vagina should be douched night and morning with some nonpoisonous antiseptic solution, such as salufer or izal.

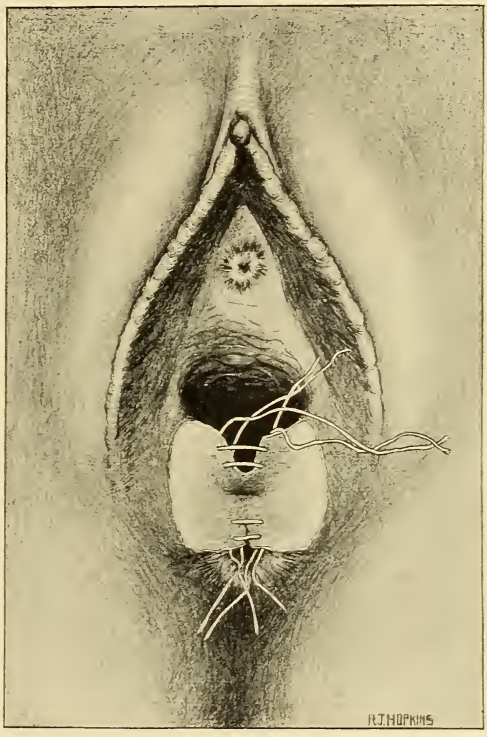

Fig. 66.—"Sutures are inserted in the margins of the vaginal mucous membrane and in the margins of the rectal mucous membrane." — Mayo Robson (page 154).

Mayo Robson's Operation.—With the patient in the lithotrity position, or on the left side, and the perineum drawn back by a retractor, so as to expose the fistula, the edges of the opening are pared by a narrow sharp knife or by means of small curved scissors. The recto-vaginal septum is then split by a blunt dissector for a quarter or half an inch round the fistula, so as to make a broad raw surface without material loss of tissue, and so as to be able to bring together the rectal part and the vaginal part by separate sutures.

Catgut sutures are first applied to the rectal edge of the fistula by means of a rectangular cleft-palate needle, the sutures taking up the submucous tissue close to, but not including, the mucous membrane, and being placed sufficiently close to occlude the rectal opening. These sutures, being applied from the vaginal surface, are tied, cut off short, and buried by the next row of sutures, which may be of chromicized catgut or of silk or silkworm gut. If catgut is employed, the stitches

may be buried; if silk or silkworm gut is used, the sutures must be tied on the vaginal surface and removed in about ten days. If the vagina is contracted, it may be found easier to repair the rectal edges of the fistulæ from the bowel surface, using a Sims speculum through the well-stretched anus.

After operation the bowels need not be disturbed for a week, and then an olive-oil injection will, as a rule, answer all requirements.

A boric acid or izal vaginal douche should be used night and morning. The employment of a catheter is, as a rule, neither necessary nor advisable. The patient may be allowed to use the sofa at the end of a fortnight.

If the fistula is fairly low, say within an inch of the anus, Mayo Robson finds it best to lay the whole fistula open by cutting through the tissues (including the perineum or its remains) intervening between it and the surface (Fig. 65). This he does by one sweep of a probe-pointed bistoury or by means of scissors, the vagina being thus made continuous with the rectum by a slit instead of a fistula. The assistants or nurses, standing one on each side, place a hand on the skin over each tuber ischii and retract gently, converting the H-shaped gap into a transverse wound, as shown in the illustration; pointed scissors are then employed to open up the recto-vaginal septum so as to convert the narrow edge into a raw surface; slits are then made on each side straight forward for about an inch, as in Tait's operation for perineorrhaphy. The angles being drawn forward by catch forceps, chromicized catgut sutures are inserted in the margins of the vaginal mucous membrane, so as to approximate them and thus form the vaginal floor by closing the V-shaped slit; and in the same way chromicized catgut sutures are inserted in the margins of the rectal mucous membrane, so

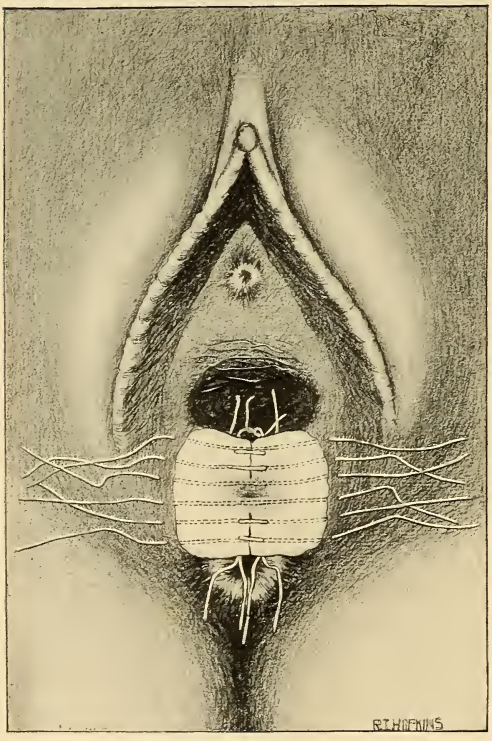

Fig. 67.—"We now have a large rectangular raw surface."—Mayo Robson (page 155).

as to form the anterior rectal wall by closing the V-shaped slit in the rectum (Fig. 66); these sutures are cut off short. We now have a large rectangular raw surface, which can be rapidly closed by four or six silkworm-gut sutures entering on one side at the skin margin, and emerging on the other at the same spot as in the well-known and extremely valuable perineorrhaphy operation referred to (Fig. 67).

Before drawing tight the last series of sutures, the wound is bathed with a 1-in-2,000 solution of perchloride of mercury. No vessels are ligatured. When the final sutures are tied the parts look perfectly normal and no raw surface can be seen. The bowels are moved daily after the second day by a plain water enema, and the vagina is washed out daily with boric lotion.

No catheter is employed if it can be avoided, and, as a rule, its use is not necessary.

The parts are dressed with iodoform gauze, over which wool and a T-bandage are applied. The sutures are removed about the tenth day and the patient is allowed to be up about the fourteenth.

Mayo Robson says that he can with the utmost confidence recommend the operation as a most satisfactory and expeditious method of treating the class of cases under consideration.

CHAPTER XV

INJURIES OF THE EXTERNAL GENITAL ORGANS (Continued)

Rape—Objective evidences: A. Local conditions; laceration of the hymen, vulva, hemorrhage, evidence of recent injury, venereal infection, laceration of the vagina, etc., pregnancy; B. Injuries on other parts; C. Condition of clothing—Schedule for examination—Indecent assault—Prolapse—Injuries to the perineum and vagina—Uterus.

Rape.—Medico-legal questions in relation to the female generative organs chiefly have reference to—

1. Pregnancy.
2. Parturition.
3. Sterility.
4. Venereal disease.
5. Rape.
6. Indecent assault.
7. Damage claims after injury.
8. Malpractice suits.

Rape is defined as the carnal knowledge of a female without or against her consent. In most courts vulvar, not vaginal, penetration has to be proved, a circumstance very disadvantageous to the defence.

In cases of rape, the gynecological specialist is rarely the first to examine the victim, who has usually passed through the hands of a police surgeon or the family physician, or both. If a gynecologist is consulted at all, it is usually when the case comes into court, or at a time when the characteristic appearances may no longer be present. It would be greatly in the interests of justice to have a regulation enforcing the co-operation of an experienced gynecologist at the very outset in every case. The significance even of the typical lesions is by no means easy to estimate, and the examinations, especially in the case of young children, often present unusual difficulty.

The **objective evidences** of rape are: (*a*) Local injuries to the genitals; (*b*) injuries elsewhere, due to a struggle, or possibly to sadism; (*c*) signs of seminal or blood stains on the clothing, tearing, etc. As the subjective evidence mainly rests on the uncorroborated testimony of the victim, the medical examination should include matters which indirectly corroborate or contradict her statements. There is no crime which becomes oftener the subject of groundless charges made

for purposes of blackmail or revenge. We will consider here those points which call specially for observation from the gynecological point of view.

A. **Local Conditions.**—These are only characteristic in the case of virgins or where unusual force has been exerted. The most important are: (1) Laceration of the hymen, (2) contusions or abrasions of the vulva, (3) hemorrhage, (4) evidence of recent injury, (5) venereal infection (gonorrhœa or syphilis), (6) in rare cases, lacerations of the vagina, perineum, rectum, or bladder may result where there is great disproportion between the male and female organs, (7) pregnancy may also occur.

1. *Laceration of the Hymen.*—The principal source of error lies in mistaking for lacerations congenital notches or defects. The appearance and variety of these are well depicted in photographs in E. V. Hofmann's *Hand Atlas of Legal Medicine.*

The variety of forms which these conditions may assume is remarkable, and the general profession is very little informed about them. The most important form is the fringed or serrated hymen. On the one hand, one of these conditions may give the impression of laceration, and on the other it is often evident that intromission could take place without rupturing it. There is also the danger of confusing ulcers with lacerations, or of mistaking old lacerations for recent ones. The examination should be made most carefully with the aid of an assistant and in a good light, the finger being passed round behind the hymen so as to bring it into relief. Whitish scars denote lesions previously existing. Granulating wounds and erosions show that the injuries have existed several days, and probably a week, if they are in process of healing. The recent defloration of the virgin hymen is usually accompanied with a considerable amount of swelling, redness, and pain. Intromission and ejaculation may, however, occur without rupture of the hymen, and, owing to the increased frequency of local gynecological treatment in young unmarried women, the hymen is liable to have been previously interfered with. A typical ruptured hymen is the exception rather than the rule in most cases of rape.

Full objective proof is only forthcoming in a small proportion of all cases. The relative proportion of the genital organs in the victim and the accused must be considered in order to give a definite answer in individual cases.

During the healing stage there is little that is characteristic in the lesions.

2. *Vulva.*—The contusions about the vulva should be associated with ecchymosis and persist for a week or ten days.

3. *Hemorrhage.*—The preservation of blood-stained undergarments, etc., is more important. Their destruction, or washing by the victim's family, may destroy an important proof.

4. If anatomical *evidence of recent injury* of the genitals is discov-

ered, it will usually be accepted as positive proof of penetration. Absence of anatomical evidence does not, however, exclude penetration.

5. *Venereal Infection.*—The presence of *acute gonorrhœal discharge* in the victim makes it most important to see if that condition exists in the accused. The diagnosis should always be confirmed by bacteriologic methods.

It is much less easy to recognise gonococci in the female than in the male secretions, owing to the constant presence of other diplococci. Examinations of stains upon linen, etc., for gonococci rarely give trustworthy results, owing to the numerous sources of possible error.

After a first coitus a slight discharge may persist for a few days, and want of cleanliness may in itself cause a discharge. Repeated visits will be necessary in order to observe the course of the case.

Syphilis.—Hard and soft chancres are occasionally met with in connection with rape. The most important point here is a careful investigation of the date of onset as compared with the date of the assault, and the exclusion of lesions elsewhere. Repeated visits are usually necessary. It must also be shown that the accused was in a condition to communicate the disease.

6. Severe injuries, such as rupture or *laceration of the vagina, rectum, bladder, or perineum,* are rare, and occasionally they are fatal. They are most liable to occur when a number of men violate the same victim in succession. In the Oriental child-marriage such injuries are fairly frequent.

7. *Pregnancy.*—The correspondence of conception with the time of the alleged coitus is naturally the chief point to establish.

B. **Injuries on other parts** should be carefully searched for, especially finger prints, scratches and bruises of the abdomen, pubes, and thighs, as well as of the chest, limbs, and face, with or without tearing of the clothing. The absence of these tends to throw doubt upon the allegations of rape, unless there was more than one assailant, or the use of narcotics, intoxicants, or anæsthetics is alleged. The vexed question of the possibility of rape during natural sleep has little practical bearing upon the ordinary class of cases. Surprise and terror may, of course, lessen the power of resistance. Conditions suggestive of sadism should lead to a very careful examination into the mental state of the accused.

C. **Condition of the Clothing, etc.**—*Seminal stains.*—Besides examining the clothing for signs of tearing, any stains looking like semen or blood should be carefully preserved and submitted to expert examination. The well-known straight outlined stiffening of the stains is striking. The skin of the abdomen and thigh should be searched for traces of the seminal crust. In the case of seminal stains the Florence reaction is invaluable as a prompt preliminary test. A drop of the Florence solution (composed of iodine, 2.5 parts; potassium iodide, 1.5 parts; and water, 30 parts) is brought into contact with moistened filaments from fabrics containing semen observed beneath the microscope. An

abundant formation of fine brown needle-shaped crystals instantly occurs. The sensitiveness is decidedly lessened in the presence of urine, and is greater in cold than warm solutions. If positive results are thus obtained, spermatozoa should be searched for cautiously by moistening the fabric by imbibition, scraping the surface, and dissociating the fibres. The best results are obtained by making a culture film or cover-glass preparation and staining with the eosin and methyl green, which gives a double staining of the head of the spermatozoa. The specimen may then be mounted in balsam and examined under a one-twelfth-inch immersion lens. Unstained specimens examined with the ordinary dry lenses are much less characteristic.

Spermatozoa are less numerous in old stains, but age does not impair the Florence reaction. To preserve suspicious stains, cut out the suspected portion of the material and place it between flat pieces of cardboard during transmission to the laboratory. The fallacies of the Florence reaction as a final test are that lecithin and certain decomposition products give similar precipitates, but this in no wise impairs its utility as a preliminary test. Failure to give the reaction does not prove the stain to be nonseminal, but makes it unlikely that positive microscopic results will be obtained.

The possibility of azoospermia must be borne in mind.

Stains from vaginal or nasal mucus or pus can sometimes be recognised microscopically by the cellular element.

Local lesions produced during rape are, as a rule, trivial, unless gonorrhœa, soft chancre, or syphilitic infections occur. Occasionally vulvar abscesses or thrombosis have occurred. Among the rare consequences, gangrene is mentioned, but the few recorded cases of this seem to have been really noma of the vulva, occurring independently and wrongly attributed to violence.

An examination of the assailant should be made as early as possible for signs of scratching or bruises, indicating attempts at defence by the victim, as well as for signs of recent coitus, seminal stains, or blood upon the shirt or drawers. The general state of muscular power should be noted and compared with that of the victim; the hands and nails examined with special thoroughness, if scratches exist upon the victim. An inquiry into the mental condition of the accused as to sanity, responsibility, and unnatural sexual instincts, should be made in every case.

The following schedule by Lacassagne will serve as a guide, when investigating a case, to guard against the possible danger of overlooking important points.

Lacassagne's schedule for medico-legal examination of a case of rape or indecent assault. Name, age, address. Date, day, and hour of visit.

Preliminary inquiry; statements about occurrence (let children talk). Examination to be made early; perineal coitus and digital attempts kept in mind. Remember frequency of simulation and false accusations.

A. *Examination of Victim.*—General condition—scrofulous, lymphatic. Local condition (examine on table or couch in a good light). Condition of thighs and abdomen—scratches, bruises, and nail marks. Labia majora and minora, clitoris for redness, excoriation, ecchymosis, ulcers. Vestibule and vagina (open and close thighs to squeeze out liquids). Hymen—position, form, margin, orifice, folds; defloration by penis, finger, or foreign body (assistant to draw forward labium on one side while expert does the same). Discharge—physical character, amount; microscopic, examine for semen and gonococci. Signs of masturbation—elongated lesser labia, large turgescent clitoris, dilated vagina, pigmentation, precocious puberty about vulva, hair, and breasts. Examination of anus and perineum.

Suspicious stains on body or clothing, especially chemise or drawers. Place under seal, noting date. Examine by Florence reaction and for spermatozoa; also for evidence of other origin of stain. Absence of spermatozoa not final.

B. *Examination of Accused.*—Physical condition, strength, cutaneous diseases. Clothing torn. Injuries, showing resistance. Sexual organs—size and appearance. Peculiarities, tattooing, hernia truss. Stains of blood or semen about person or clothing. Urethral discharge (look for semen if seen very promptly). Chronic purulent discharge. Alleged impotence. Mental condition as to sanity or full responsibility.

Conclusions.—A. (1) Has the person been the victim of rape or sexual assault? (2) How has the assault been made? (3) Has there been perineal coitus or intromission of the penis or finger? (4) Is there redness, contusion, or laceration of the parts or defloration? (5) Has any disease been communicated? Is such disease syphilitic? (6) It will be necessary to re-examine in —— days to note progress of wound.

B. (1) Does accused show traces of recent or old venereal disease? (2) Is such disease of same nature as that found on victim? (3) Are there traces of a struggle or of suspicious stains? (4) Is accused subject to bodily infirmity making coitus impossible? (5) Is his mental condition normal or otherwise?

Indecent Assault.—In a large proportion of cases the victim is usually a little girl under ten years. The attempt is most often made with the finger. As a rule, the signs of a struggle are absent, and on this account the establishment of direct proof is often impossible. The local evidences are usually slight inflammation and reddening with or without laceration of the hymen. A slight discharge often follows. The method of examination is the same as in cases of rape.

In such cases care must be taken to exclude local conditions, which frequently cause spontaneous vulvo-vaginitis in children. The presence of the gonococcus is significant, but the possibility of infection from other children or from members of the family must be borne in mind.

Evidences of masturbation, such as an elongated or turgescent cli-

toris with pigmented labia, should be looked for. The pigmentation is usually unilateral. It must be borne in mind that children are naturally mendacious, and may either originate a story of assault themselves, or accept one suggested to them by their parents, or by leading questions put to them by their parents, or by leading questions put to them in the course of the medical examination.

Fournier's classical advice to medical men charged with the investigation of these cases, that one should close his ears and open his eyes, is to be kept constantly in mind. Another excellent rule is to refuse to give a medical certificate to be used by the friends of the plaintiff as the basis of the case.

The civil consequences of injuries to the female genital organs have been but little studied or described. C. Thiem was the first to systematize and collate our knowledge on the subject, and since then a fair number of observations have been recorded.

The disabilities resulting from injuries may be classified as follows:

Gynecological effects of injury in relation to disability and claims for damage.

The effects of accident and injury upon the female genital organs may be classified as follows:

1. Malposition of uterus due to accident.
2. Injury to perineum and vagina.
3. Injury to vulva.
4. Injury to uterus.
5. Injury to uterine appendages.

Occasionally the injury may be the sole cause. More often it may act by aggravating existing disease. It is important to remember that the condition must be shown to arise from a single act of traumatism or overexertion, to be considered as the effect of accident.

There is no evidence to show that retroversion of the nonpregnant uterus, or that anteversion, or anteflexion, or retroflexion, is ever primarily a result of accident in healthy persons.

Any of the above malpositions, if already existing, may be, however, aggravated by falls, or contusions of the pelvic region.

Prolapse.—A number of cases are reported by Thiem and others where prolapse has followed accidental straining and heavy lifting. The proof needed to establish this, is sudden and painful onset with swelling, œdema, and tendency to inflammation of the prolapsed parts. This should immediately follow the alleged accident or should produce a certain amount of immediate disability. A thickened or smooth condition of the prolapsed portion, with signs of ulcers from attrition, and ease of reposition, should readily enable old cases to be excluded. It may be assumed that prolapse only occurs as a result of accident in persons locally predisposed to it. The amount of disability (loss of earning power) in the labouring classes is from ten to twenty-five per cent, according to the success with which reposition by supports can be maintained. Operation can not be insisted upon if objected to. The

aggravation of an existing prolapse by accident may also require compensation.

Injuries to the perineum and **vagina** occur usually through falls in a straddling position or from impalement; they generally leave no permanent disability if the immediate effects are recovered from. Laceration of the posterior vaginal wall is the most serious lesion. Indirect laceration from forcible separation of the thighs during falls has been observed. The effects are, of course, most serious when this occurs in pregnant women.

In injuries of the vulva and vaginal orifice, hematoma is the commonest result of injury. It leaves no permanent disability. Tumours of the vulva have not yet been recorded as the result of a single injury.

Uterus.—The nonpregnant uterus is only liable to injury in connection with some very severe violence, such as fracture of the pelvis; but when enlarged from tumours or pregnancy it becomes exposed to external trauma; interruption of pregnancy, if such exists, is liable to occur, but often does not.

Cases of pelvic hematocele from trauma have been reported, but in those cases where metrorrhagia ensues, the existence of pregnancy is extremely probable. The abdominal hemorrhage from ruptured tubal pregnancies is practically never due to trauma. Torsion of the pedicle of ovarian tumours was found by Thornton to be traumatic in 16 per cent of six hundred cases. Laceration and hemorrhage of ovarian tumours from contusions of the abdomen have been observed.

Hydrosalpinx and pyosalpinx never arise from trauma.

CHAPTER XVI

INFECTIONS OF THE EXTERNAL GENITAL ORGANS

Preliminary remarks—Vulvitis and vaginitis—Bacteriology of the external genital organs—Mixed infections—Gonorrhœa—Extirpation of the vulvo-vaginal glands—Tuberculosis; vulva; vagina—Erysipelas—Erysipelas and puerperal infection—Diphtheria—Aphthæ—Aerogenous infection—Bilharzia—Chancroid—Hard chancre—Late syphilitic ulcers.

Infection of the vulva, the vulvo-vaginal gland, and the vagina, depending upon the action of specific micro-organisms, may or may not be limited to—i. e., arrested within—the intrauterine segment of the genital tract. There is a proneness on the part of particularly the more vigorous pathogenic bacteria to progressively invade contiguous mucous areas; it follows, therefore, that infection, once established in the vulva or vagina, is liable to extend upward, involving the endometrium, the mucous lining of the Fallopian tubes, the peritoneum, and the intrapelvic lymphatics. A proper comprehension of the general subject of infection of the female genitalia involves, therefore, a study of the various pathogenic bacteria (see Sepsis), a consideration of the micro-organisms known to be involved in the infection of these organs, and, finally, a study of the infection, not alone of any one organ, but of the entire genital apparatus.

Vulvitis, or inflammation of the vulva, and **vaginitis,** or inflammation of the vagina, were formerly recognised as clinical entities; at present, however, vulvitis is discussed under the various forms of skin disease of the vulva, or as the result of the action of micro-organisms or of traumatism, while vaginitis can hardly longer be said to exist except as the result of either infection or injury. Inflammations of the external genital organs or of any part of them, except such as occur in the recognised forms of skin disease (see Disease of the Skin of the Female Genitals), will, therefore, be discussed under the heads of Infections and Injuries.

Bacteriology of the External Genital Organs.—The bacteriology of the vulva and vagina in both health and disease has been very carefully investigated by numerous observers. Pioneer work was done by Haussman, Kehrer, and Karewski, with primitive methods of investigation which naturally militated against the accuracy of their results. Stroganoff, of St. Petersburg, has investigated the bacteriology of the vagina of the newborn child, and finds that it is free from micro-organ-

isms, which, however, may enter soon after birth. Baths, washings, and especially the application of oleaginous substances, such as are frequently used in the early toilet of newborn children, favour the entrance of germs. Winter (*Centralblatt für Gynäkologie*, No. 17, 1888) found numerous organisms in the vagina and upon the pudendal structures, in neither of which were there any manifestations of disease. An interesting fact was that he found staphylococci, including the *Pyogenes albus*, *aureus*, and *citreus*, together with numerous streptococci, all of which, in morphology, pigmentation, and behaviour in culture media, were identical with similar bacteria found in other loci where they possess pathogenic properties; they differed, however, in the particular that inoculation experiments indicated that they were innocuous. All investigators agree that all pathogenic bacteria lose their virulence the nearer they approach the cervix. This circumstance at once raises the question whether or not the cervical and vaginal secretions have the effect of depriving these bacteria of their virulence.

In answer to this question may be cited the observations of Döderlein, who has found a bacillus which does not grow upon many of the usual media, but may be cultivated on sugar bouillon and sugar agar. It produces an acid, apparently lactic, upon which the usual acidity of the vaginal secretion depends. Lactic acid, which is elaborated by this bacillus in considerable quantity, is presumed to be the agent which either destroys the life or neutralizes the virulence of the pathogenic organisms. In confirmation of this theory large quantities of pus-producing organisms introduced within the vagina disappeared completely within a few days. This acid-forming bacillus, which stands as a sentinel at the introitus and along the vaginal wall, does not itself produce pathologic symptoms, and consequently plays no part in the causation of sepsis. Döderlein is of the opinion that this micro-organism and the products of its vitality are able to resist the invasion of streptococci, which probably never reach the uterus unless either carried there mechanically or escorted by the more powerful pus-formers. These latter, notably the gonococcus, overpower the bacillus of Döderlein and march practically unopposed to the remotest reaches of the genital tract. The fact that the *Bacillus aerogenes capsulatus* manifests its activities upon or near the cervix indicates that it is not amenable to the influence of this micro-organism.

The importance of bacteriological examination of secretions found upon the vulva and in the vagina can hardly be overestimated. The lesson taught by the investigations of Döderlein and J. Whitridge Williams is conclusive upon this point. The investigations of these gentlemen show that the normal vaginal secretion is of very small quantity, of whitish, crumbling material, of the consistence and appearance of curdled milk, containing no mucus, and giving an intensely acid reaction to litmus, while microscopically it consists entirely of vaginal epithelial cells and a relatively few large bacilli. The pathologic secretion, on the other hand, is of a yellowish or greenish-yellow colour,

creamlike in consistence, often containing gas bubbles (dependent upon *Bacillus aerogenes capsulatus*) and a little mucus, and varies in reaction from weakly acid or neutral to alkaline, while microscopically it consists of epithelial cells, numerous pus corpuscles, and all kinds of bacilli. Stroganoff found that micro-organisms seemed to increase in abundance in the vaginal secretion preceding and following menstruation.

J. Whitridge Williams made a critical study of the secretion in the vaginæ of ninety-two pregnant women, upon which he based practical conclusions (*Transactions of the American Gynecological Society*, 1898) as follows:

1. We agree with Krönig that the vaginal secretion of pregnant women does not contain the usual pyogenic cocci, having found the *Staphylococcus epidermidis albus* only twice in ninety-two cases, but never the *Streptococcus pyogenes* or the *Staphylococcus aureus* or *albus*.

2. The discrepancy in the results of the various investigators is due to the technique by which the secretion is obtained.

3. As the vagina does not contain pyogenic cocci, auto-infection with them is impossible; and when they are found in the puerperal uterus, they have been introduced from without.

4. The gonococcus is occasionally found in the vaginal secretion, and during the puerperium may extend from the cervix into the uterus and tubes.

5. It is possible, but not yet demonstrated, that in very rare instances the vagina may contain bacteria, which may give rise to sapræmia and putrefactive endometritis by auto-infection.

6. Death from puerperal infection is always due to infection from without, and is usually due to neglect of aseptic precautions on the part of the physician and nurse.

7. Puerperal infection is to be avoided by limiting vaginal examinations as much as possible and cultivating external palpation. When vaginal examinations are to be made, the external genitalia should be carefully cleansed and disinfected, and the hands rendered as aseptic as if for a laparotomy. Vaginal douches are not necessary, and are probably harmful.

Mixed Infections.—A brief consideration of the preceding paragraphs relative to the bacteriology of the external genital organs makes it evident that they are the frequent seats of coincident infections by different micro-organisms. In cases of pelvic suppuration discharging into the genital tract, both staphylococci and streptococci are generally found, together with other pathogenic micro-organisms. In gonorrhœa the diplococcus of Neisser is never the only pyogenic organism present; and in the destructive stages of tuberculosis the tubercle bacillus is always found in association with other germs. There are cases, however, in which the pathologic changes and clinical phenomena are so distinctly attributable to a particular micro-organism that the infection is given its name rather than that of its congeners. In this category

may be mentioned particularly (*a*) gonorrhœa, (*b*) tuberculosis, (*c*) erysipelas, (*d*) diphtheria, (*e*) aphthæ, and (*f*) aerogenous infection.

Gonorrhœa in women was once thought to be a disease restricted to the vulva, the vagina, and the urethra; but since the days of Tait and Noeggerath it is known that infection of the lower genital canal if left to itself may become a progressive invasion of the mucous tract, causing infection of the endometrium, the Fallopian tubes, the peritoneum, and the pelvic lymphatics. (See Endometritis and Pyosalpinx.) It should be remembered likewise that the lower segment of the urethra is also, coincidently with the vagina and vulva, a seat of primary infection, and that from this locus it may extend upward, involving the bladder and even the kidneys. (See Cystitis.) The cause of this infection is the gonococcus of Neisser (see Fig. 17). This organism is the morbific agent that is distributed chiefly through the avenue of the "social evil," and restrictive measures have been taken in all enlightened communities to diminish its ravages. The prevalence of this micro-organism in the vaginal discharges of prostitutes has been a frequent subject of investigation. Laser, of Königsberg, examined a number of prostitutes with the result that the gonococcus was found in the urethra 111 times in 353 cases; in the vagina 7 times in 180 cases; and in the cervical canal 21 times in 67 cases. These figures indicate that this micro-organism finds a favourable habitat equally in the urethra and in the neck of the uterus, and the least favourable abiding place in the vagina—a conclusion which supports the observation of Döderlein relative to the phagocytic action of the acid-forming bacillus of the vagina. Out of the 353 patients examined by Laser for gonococci in the urethra, four fifths of the 111 cases that revealed this micro-organism gave no macroscopical evidence of gonorrhœa. In 241 patients in whom no gonococci were discovered, there was more or less inflammation of the mucosa, often with a suspicious discharge. It follows, therefore, that while infection of the genital and urinary tracts may depend upon organisms other than the gonococcus, the latter, in a degenerated form located deep in the mucous folds and follicles, but especially in the crypts of the vulvo-vaginal gland, may be a persistent cause of the disease, even when it can not be detected in the discharges. It is evident from these facts that gonorrhœa in women should be classified as *acute* and *chronic*.

Afanassiew (*Gazette de gynécologie*, No. 167, p. 173) reports the results of bacteriological investigation of the lochia of twenty-four parturient women. Out of sixty-eight examinations, he obtained cultures in nearly all the cases. The bacteria diminished in the vagina from without inward, and were fewest at the uterine cavity—an observation confirmatory of the conclusions of Döderlein. They were living and culturable, notwithstanding daily washing of the canal with carbolized water of 2-per-cent strength.

The gonococcus of Neisser is often demonstrable in secretions from the vagina and vulva. These organisms are frequently found in appar-

ently nonpurulent secretions long after the period of acute infection has passed; their virulence, however, under such circumstances is generally greatly reduced, often to the degree of having lost their pathogenic properties. (See Gonorrhœa in Women.) Freymuth and Petruschky (*Deutsche medicinische Wochenschrift*) have found the diphtheria bacillus in noma of the vulva. The same organism has been demonstrated in exfoliative vaginitis not associated with gangrenous ulceration, while Elsner and others have reported puerperal diphtheria involving the vagina and endometrium. The *Oidium albicans* has been demonstrated in aphthous inflammations of the vulva and vagina in both children and adults.

The symptoms of acute gonorrhœa in women consist of a burning pain on urination located at first in the meatus urinarius, and next upon the inner and erythematous surfaces of the vulvar folds; and in a copious creamy discharge, bathing the vulva and matting the pudendal hair. On inspection the vulva reveals areas of erythema, which, after a few days, owing to the destruction of the epithelium, may become distinct erosions; the urethra is tender to the touch, swollen, and its mucous membrane is more or less everted at the meatus urinarius. The *diagnosis* may be made presumptively upon the foregoing symptoms coupled with the fact of probable exposure to infection; but it can be made positively only upon the demonstrated presence in the discharge of the gonococcus of Neisser. The practitioner should be very cautious in giving a final diagnosis of suspected cases of gonorrhœa, on account of the possible social and medico-legal contingencies that may arise. The *symptoms of chronic gonorrhœa* in women are more obscure. There is generally a history of a preceding acute attack, the exact character of which may not be known to the patient herself, but which can be determined, at least approximately, by well-directed interrogatories. Following the supposed cure of the acute attack there has been a persistent catarrhal discharge, varying in colour from a whitish to a slightly yellowish tint, and varying in quantity from slight to considerable. If these conditions exist associated with a present or a past suppuration of the vulvo-vaginal glands, and if there is a petechial purplish red area about the orifice of the vulvo-vaginal ducts, the presumption of chronic gonorrhœa is strengthened. If the mischief in the vulvo-vaginal glands has gone to the extent of suppuration, resulting in fistulæ or cystic degeneration, the diagnosis may be considered as confirmed. The involvement of the urethra, dark-red spots upon a yellowish-white streaked base upon the vulva, and venereal warts, are complications of conclusive diagnostic significance. Oskar Bodenstein (*Deutsche medicinische Wochenschrift*) quotes Sänger to the effect that the local application of a 50-per-cent solution of zinc chloride will cause the granules in the vaginal mucous membrane to spring into relief in chronic gonorrhœa—a convenient diagnostic expedient that is certainly worthy of investigation.

The pathology of gonorrhœa in women has been understood but re-

cently. Its comprehension involves a study, not so much of the changes that occur in the vulva, vagina, and urethra, as of those occurring in the bladder and kidneys, and in the uterus and its adnexa, to the chapters upon which subjects the reader is referred. The pathology of gonorrhœal infection of the vulva and vagina is essentially the pathology of an infective inflammation. The micro-organisms, finding a lodgment upon the mucous surfaces of the urethra, in the muco-cutaneous folds of the vulva, or those about the introitus vaginæ, readily propagate in the secretions which act as culture media. The direct irritating influence, both of the organisms themselves and of the products of their vitality, results in the establishment of the ordinary phenomena of inflammation—congestion, stasis, exudation, etc. The direct action of these organisms and their products is, to a certain extent, destructive of the epithelium, which, however, would probably withstand the assaults of the invaders if it were not for the circulatory and nutrient changes in progress in the underlying structure. Through these combined influences the protective epithelium is broken down and there is more or less direct invasion of the underlying cuticular structure; but even here the intrusive cocci are confronted by other defenders of the system in the form of leucocytes. Cocci develop rapidly, however, overcome their cellular antagonists, and find their way into the fimbriated intercellular substance and into pre-existing cells of the tissue and in the vessel walls. While these changes are in progress, however, the mucous follicles are invaded, and with the first temporary recession of the local circulatory pressure these follicles are stimulated to extreme activity, manifested in that hypersecretion which is generally designated as catarrhal. In the presence of a virulent infection these follicles and glands, including even the vulvo-vaginal glands, may suffer the loss of their epithelium and themselves become the avenues for tissue infection. Local abscesses as the result of gonococcus infection but rarely occur, except in the vulvo-vaginal gland, the efferent duct of which may become occluded, converting the gland into a suppurating retention cyst. Tissue invasions, such as have been described, more frequently result in permitting the passage of the pyogenic organisms—for by this time the infection has generally become more or less mixed—into the lymph channels, whence they are carried to the lymphatic glands, particularly to those in the groin, where, not infrequently, the infection results in abscesses. Coincidently with these changes there occurs more or less systemic intoxication, expressed, it may be, by an initial rigour; this is followed by an elevation of temperature, which persists with slight but irregular vacillation until the focus of suppuration has been opened and drained.

Treatment.—When gonorrhœa is limited to the vulva, the urethra, and the ostium vaginæ, it should be treated by rest, and antiseptic lotions of either boric acid or bichloride of mercury emollient applications. The vagina will seldom be invaded unless the infection is carried upward by mechanical means. This, however, is what unfor-

tunately happens in the majority of cases long before the physician is consulted. The patient of her own accord is prone to use the douche; or, may be before she has become aware of her condition, she has indulged in repeated acts of coition. The physician is, therefore, called upon at the very outset to treat a thoroughly infected vagina. Under these circumstances there is no disease with which women are afflicted that calls for more prompt, more vigorous, and more efficient treatment than that of acute gonorrhœa. Its probable extension to the upper reaches of the genital tract, with the inevitable complications thereby engendered, should stand before the practitioner as a spectre warning him to the fullest discharge of his duty. The treatment of acute gonorrhœa is essentially bactericidal. It should begin with a thorough cleansing of the parts; this can be accomplished thoroughly only by first shaving the pudendum; a douche of tepid water, either clear or holding in solution some borax or sodium bicarbonate, should be used to cleanse the vulva and the vagina; after this has been thoroughly done another douche of 1-to-2,000 bichloride solution should be employed for a period of from ten to fifteen minutes. This douche should be given, as should the preceding, with the patient lying upon her back, her buttocks drawn to the edge of the bed, in which position the nurse can practise most thorough cleansing of the vagina by repeatedly holding her hand over the vulva, thus forcing the retention of the irrigating fluid in the vagina; the hydrostatic pressure thus exercised will occasion that degree of distention of the vagina which will cause an obliteration of the folds and the exposure of its entire surface to the action of the medicament. Care should also be taken to bring the antiseptic solution in contact with every part of the infected area of the vulva. An older and possibly more efficacious, but certainly more severe, treatment consists in cleansing the parts as above described, and in then introducing a speculum, widely distending the mucous membrane of the vagina, which, with the entire vulvar surface, is cauterized with a solution of nitrate of silver, twenty grains to the ounce; this cauterization, to be effective, should be thorough and should include every part of the mucous membrane. After the silver nitrate has been applied, a loose pledget of cotton, saturated with glycerine, should be carefully inserted, not so as to pack the vagina, but to lie lengthwise in the canal, preventing the approximation of the cauterized surfaces. Other remedies, such as the zinc sulphate, plumbic acetate, tannin, carbolic acid, lysol, and creolin, have been suggested and may be employed; they, however, possess varying germicidal properties, none of them being so valuable as either the mercuric bichloride or the silver nitrate. When the nitrate of silver is used, it should not be reapplied under three or four days. It should be remembered that antiseptic treatment, to be effective, should be continued until the symptoms of infection have subsided. It is not enough to kill an existing generation of bacteria, even though it were possible to do so in a given case, for it should be remembered that many of these micro-organisms propagate by spores, which resist more effectively than

do the parent organisms themselves the action of germicidal agents. Döderlein has emphasized the importance of repeated disinfections of the genital tract, for the purpose of securing sterilization, and his teachings should pass into an axiom of practice. The treatment of chronic gonorrhœa in women involves a much more comprehensive regimen. It must be based upon a comprehension of the pathologic changes that have occurred in the case at hand. This may involve the application of surgical expedients to the bladder, the kidneys, the uterus or its adnexa, or to the pelvic lymphatics. So far as the treatment of chronic gonorrhœa of the lower genital tract is concerned, it will resolve itself into a persistence in antiseptic measures, or the extirpation of the vulvo-vaginal gland, which is generally found to be the persistent *fons et origo* of the disease. The antiseptic treatment should consist in the continued practice of irrigation with strong solutions of bichloride of mercury or carbolic acid, always taken in the recumbent posture, the douche bag being elevated from four to five feet above the patient, the nurse practising forced retention of the fluid in the patient's vagina. It should be kept in mind that chronic gonorrhœa of the vagina is a deep-seated process, for the successful treatment of which vaginal distention is a necessity. Forcible tamponade of the vagina, particularly in the lateral fornices and in the upper segment of the canal, should be practised by saturating a long slender cotton tampon with sterilized glycerine. The exosmotic influence of this agent has a tendency to wash the micro-organisms out of their hiding places and to bring them in contact with the stronger sterilizing agents. In these cases it is of special value to distend the vagina to the extreme by means of a multivalvular speculum, and to cauterize the thus tense and distended mucous surface with a strong solution of nitrate of silver, followed with glycerine tamponade. The escharotic influence of the silver salt is not sufficient to produce serious destruction of the mucous membrane, unless frequently applied—i. e., oftener than every three or four days.

Extirpation of the vulvo-vaginal glands should be practised whenever they have become the seat of gonorrhœal infection, as evidenced by either repeated suppurations or cystic degeneration. This gland is also the occasional seat of malignant disease, the existence of which is an indication for its prompt removal. This is an operation of more magnitude than the anatomic structures involved would seem to imply. With the patient in the dorsal position, the vulva having been completely sterilized, the labia of the affected side are retracted by the hands of the assistant or nurse, and an incision is made over the gland just at the base of the labium minus. If the gland is distended, dissection should be made with considerable care until the cyst, as the gland may be now designated, is encountered; an effort should be made to carefully enucleate this body, which will be found to be held in position by a sort of ligamentous structure, conveying its nerves and nutrient vessels. These are of sufficient magnitude to occasion severe hemorrhage, and

if they are permitted to elude the grasp of the operator, they retract along the vaginal wall to such an extent that they are re-secured with extreme difficulty. Care should be taken, therefore, to get them within the grasp of a hemostatic forceps before excising the gland, and to ligate the pedicle before taking off the forceps; the wound should then be closed aseptically and dressed with protective pads. If closed by the buried suture the liability of subsequent infection from external causes is minimized.

Tuberculosis of the vulva is a specific inflammatory disease of the external genitalia, caused by the presence of the tubercle bacillus and characterized by both the anatomic lesions and clinical course of lupus. It may exist as a primary disease confined to the vulvar region or a secondary manifestation of tuberculous lesions in the lung, intestine, or internal genital organs.

A clear definition of tuberculosis of the vulva is extremely difficult to give in the presence of the confusing classifications of different authors, and must in reality include a very extended description and differentiation of the conditions—ulcus rodens vulvæ, elephantiasis, lupus vulvæ, l'esthiomène, and destructive ulcer. Veit, Schröder, Pozzi, and many others have described ulcus rodens vulvæ as a distinct lesion, but they also state that the tubercle bacillus has often been found in such ulcers. It will certainly simplify the subject greatly and bring it more within the limits of this short article to look upon this division as *sub judice*, and to describe only a tuberculosis of the vulva.

Etiology.—Until recent times tuberculosis of the vulva has been considered so rare that it has been given no place, or only passing mention, in the accepted text-books of gynecology; but the reported cases of Demmé, Schenck, Kuttner, Karajan, Paoli, Kelly, Rieck, and others, would indicate that the disease occurs with greater frequency than is generally believed, and that this condition must always enter into the diagnosis of vulvar ulceration. Barbier (*Gazette médicale*) believes that a woman can be infected by a tuberculous man during coitus. Bacilli have been demonstrated in the semen as well as in the discharge attending tuberculous epididymitis. The uterus may be infected by extension from a tuberculous growth on the vulva, without any intermediate trace of infection in the vagina. He even admits the possibility that tuberculous infection may be transmitted by the finger of the attendant, by unclean instruments, or even through the medium of the air. It is manifest, however, that infection transmitted in this way must be taken up through some rent in the continuity of the epithelium.

The disease occurs alike in children and adults and without reference to the general nutrition. The infection would seem to be by the direct inoculation of a skin abrasion by means of the nails, by infected dust, by tuberculous stools, or by coitus. The case of Schenck occurred in a child who had two tuberculous playmates, and who had no other tuberculous manifestations. Prostitutes are most frequently attacked,

a fact that has its explanation in their great liability to direct infection, in continued irritation, and in lack of cleanliness. Masturbation serves as a predisposing cause, and syphilis also by lowering the resistance of the tissues. Koch has considered extirpation of the inguinal glands to be a predisposing cause.

Morbid Anatomy.—The starting point of the tuberculous process is usually in the region of the urethral orifice or the clitoris, or in the posterior commissure. The lesion begins as a single or as multiple hard masses, of a dark-red or livid colour, which develop in an indurated skin and increase in size very slowly. This mass may exist for a long time as a firm nodule, or in the clitoris as a hypertrophy, or it may soften in the centre and break down to form a small, raised, unhealthy ulcer with ragged edges, which exudes a serous fluid. It is in this stage of ulceration that the patient usually presents herself for treatment. When the lesions are multiple, a number of such discrete ulcers will form on the vulva and gradually run together to form an extensive area of tuberculous granulations involving the entire vestibule, clitoris, labia, and lower part of the vagina. The granulations of such an ulcer are unhealthy, friable, do not bleed easily, and show no tendency to caseation. The surface is covered by a sero-purulent exudate. There is a rich vascularization of the part and the tissues around and beneath the ulcer are strongly infiltrated, but not markedly indurated. These ulcers are apt to be serpiginous in character, healing behind as the advance is made. A very characteristic feature of the disease is a rough, tense, hard elephantiasic thickening of the labia or clitoris, or both, which causes them to swell to two or three times their normal size. In fact, in the cases of Karajan and De Sinerty the operation was done for elephantiasis of the clitoris, and the tuberculous nature of the disease was revealed only by histological and bacteriological examination. A microscopic examination of these ulcers shows the base to be made up of a thin layer of tuberculous granulations and

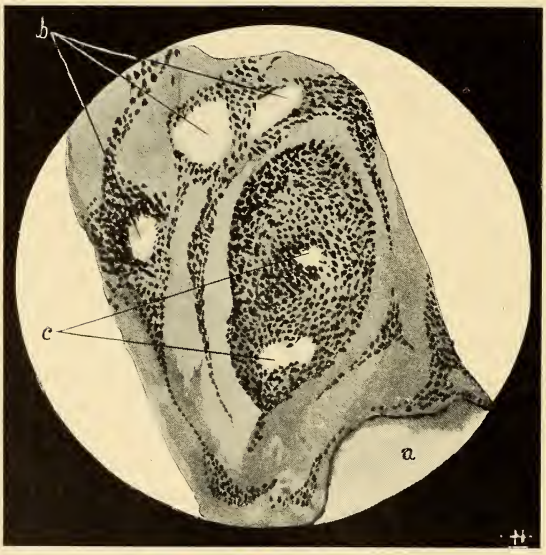

Fig. 68.—"A low power shows the caseous areas (*b*, *c*) in the tuberculous tissue and an occasional fistulous tract (*a*)."—Whitacre (page 173).

the raised edges of solid tuberculous tissue containing more or less typical miliary tubercles. A low power (Fig. 68) shows the caseous areas in the tuberculous tissue and an occasional fistulous tract. A high power (Fig. 69) demonstrates small round cells and giant cells around the irregular caseous areas. Tubercle bacilli may be demonstrated (Fig. 70) among the small round cells in the secretions or in the newly formed tissue. It must be remembered, however, that in the serpiginous course of such a tuberculous lesion the older parts of the ulcer may show the entire absence of tubercle bacilli, as is shown by the interesting case of Rieck (Fig. 71). The involvement of the urethra is progressive, its inner surface loses its real mucous-membrane character, is more or less exposed, and may be converted into scar tissue. The meatus appears to be torn laterally, as Emmet has pictured it for the cervix. The process continues until the urethra is almost entirely destroyed and is represented by a funnel-shaped ulcer.

Fig. 69.—"A high power picture demonstrates small round cells and giant cells around the irregular caseous areas."—Whitacre.

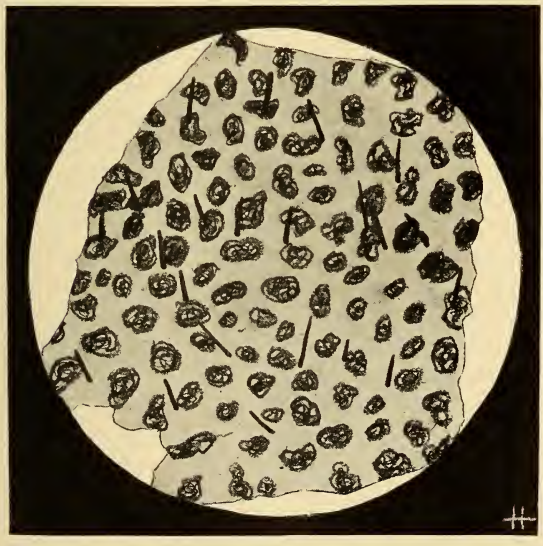

Fig. 70.—"Tubercle bacilli may be demonstrated among the small round cells."—Whitacre.

The course of the ulcerative process is very slow, however, and the inguinal glands remain free for a remarkably

long time. Cicatrization is sometimes associated with the ulceration, as an evidence of a tendency to spontaneous healing, and may lead to great deformity.

Fistulæ often form a marked feature of the disease, and especially in ulcus rodens vulvæ. A tendency to a deep penetration of the tissues may be present from the start. They first form underneath the mucous membrane, but very soon penetrate deeply, and may communicate with the rectum high up at the upper end of the perineal triangle. Three or four sinus openings on the vulva may coalesce below the surface and open into the rectum as a single channel. Ulceration in the perineal body may be so extensive as to form a cloaca.

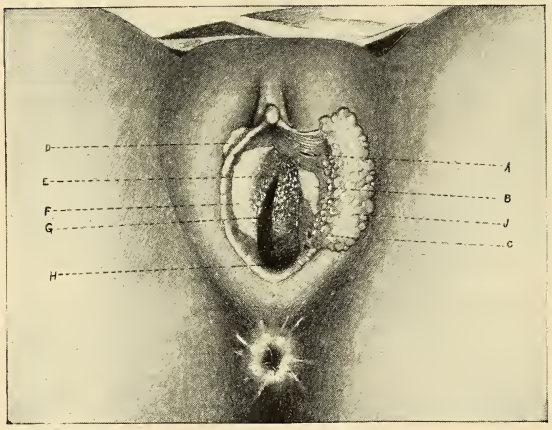

Fig. 71.—The case of Rieck: *A*, *C*, sinus openings; *B*, *F*, scar-tissue; *D*, a small tumour containing typical tubercle tissue; *E*, ulcerated surface; *G*, urethra; *H*, introitus vagina; *J*, elephantiasic thickening of left nympha.—Whitacre (p. 173).

Symptoms. — The first symptom of primary tuberculosis of the vulva is often a stinging pain on urination, caused by the urine coming in contact with a minute ulcer at the orifice of the urethra. At other times an ulcer giving no symptoms is discovered by the patient, or the nympha of one side, or the clitoris, is found to be increasing in size. A physical examination will reveal the presence of one or more ulcers possessing the above-named characteristics. The course of such an ulcerative process is extremely slow, and may continue for many years as a local phenomenon without affecting the general health of the patient. The dribbling of urine and rectal irritation will, of course, be present in the advanced cases as most distressing symptoms. Death will eventually result from involvement of the internal organs.

A secondary tuberculosis of the vulva takes a much more rapid and malignant course; furthermore, the vulvar disease often possesses little significance in comparison with the primary lesion in the lung or other organs.

Diagnosis.—The diagnosis of this condition possesses a considerable degree of importance, first, because of the necessity of radical treatment, and, secondly, because of the difficulty experienced in arriving at a correct diagnosis. Askanazy has explained certain of these difficulties by the demonstration that we may meet with tumours not differing in their microscopical anatomy from typical tuberculosis, but

characterized clinically by an absence of all tendency to caseation, abnormally large size of tumour formation, firm consistence, and, lastly, by a tendency to fibrous metamorphosis which may eventually lead to a complete obliteration of all specific tuberculous attributes.

The association of ulceration with elephantiasic thickening of the labia, the slow development, the chronicity of the ulceration, and, most important, the demonstration of tubercle bacilli in the secretions, will serve to distinguish it from carcinoma. Simple elephantiasis is not associated with ulceration. Chancroid will usually be diagnosed by its history and clinical characteristics, by the absence of elephantiasis, by its multiple character, by its short duration, and by the absence of extensive and deep destruction of tissue.

Treatment.—The treatment of tuberculous lesions of the vulva is surgical, and a radical removal of all diseased tissue should be resorted to whenever this is possible. This will often require an extensive plastic operation, and it should be remembered that a considerable removal of urethral tissue can be made without impairing the function of the bladder (Kelly, Schröder, Paoli). When this is not possible, thorough curetting with a sharp spoon, followed by cauterization with strong acids, may be tried and repeated as often as the disease recurs. Deep cauterization by the electro-puncture serves as an excellent method of thoroughly removing the diseased tissue and securing good cicatrization. The ulcers unfortunately heal very well oftentimes under such simple applications as iodine or acids, but this cure is not permanent, and the ulcers recur. Under any plan of treatment these cases should be carefully followed up and the slightest recurrence treated as radically as the original focus of infection. Enlarged glands in the groin should be removed at the time of the primary operation or in the instance of their later enlargement. Either as an auxiliary to the ordinary methods of treating lupus, or as an independent method, Unna advises (*Monatshefte für praktische Dermatologie*) the following lotion: ℞. Corrosive sublimate, 1 part; carbolic acid or creosote, 4 parts; alcohol, 20 parts. The nodules are attacked in series of tens, beginning with those at the edge of the patch. They are first punctured with an acne lance, and a minute shred of absorbent cotton moistened with the lotion is inserted by means of a sharpened stick, the cotton rotated and allowed to remain for ten or fifteen minutes. In a few days the punctures and lupus deposits so treated have almost disappeared, and other nodules may be then similarly attacked. This method, Unna believes, has many advantages over the somewhat similar plan of treatment by means of the nitrate-of-silver stick.

Tuberculosis of the vagina is usually associated with tuberculosis of the higher portions of the genital tract, but a number of cases have been reported in which no other focus could be discovered in the genital tract, and a single case is reported by Friedländer in which a vaginal ulcer represented the only tuberculous lesion to be found in the entire body. The vagina certainly may be infected from a tuberculosis of

the peritoneum or tube without involvement of the intervening organs (Oppenheim), and it was Reynaud who first explained the usual seat of the first vaginal lesion in the posterior fornix, by the observation that it was here that virus-laden secretions from above first came in contact with the vagina. The infection may also be introduced from without by coitus with men suffering from a tuberculous disease of the sexual organs, by the hands or instruments of the physician or midwife, from the urine, from filthy bed linen or wearing apparel, from the air, from the blood (Davidsohn), and by infection in continuity of tissue from neighbouring organs, as in vesical or rectal fistulæ.

The infrequency of the disease in both the vagina and vulva, as compared with that of the higher organs, is probably to be explained by the natural resistance of squamous epithelium to bacterial invasion, and it is only after injury, abrasion, or the action of irritating secretions, that the tubercle bacillus can gain entrance to the tissues.

The disease occurs with greatest frequency during the period of sexual activity (twenty to forty), yet seven and seventy-nine represent the two extremes of age in the collected cases.

Morbid Anatomy.—Two cases in particular are reported where the entire lesion consisted in an eruption of perfectly typical, fresh miliary tubercles over the entire vaginal wall. These tubercles were of millet-seed size, and were made up microscopically of giant, epithelioid, and small round cells, which were supported by a delicate reticulum and showed areas of caseation. Tubercle bacilli were present. Favoured by moisture and warmth, these miliary tubercles soon break down to form minute ulcers, or by their confluence will form larger sharply defined but irregular ulcers. Such ulcers are characterized by perpendicular edges, a depressed grayish or yellowish-gray base, studded by tubercles and covered by caseous material, a size varying with the extent of the confluence, and a decided tendency to the serpiginous type. Such an ulcer is usually surrounded by an area of hyperæmia, which is more or less filled with small, yellow, opaque, grainlike miliary tubercles. The usual seat of ulceration, as has already been stated, is in the posterior fornix. When the infection is from without, however, the lower portion of the vagina will be first involved. Tuberculous fistulæ are found in the later stages of the disease and are formed, as a rule, by an ulceration into the connective tissue, thence into urethra, rectum, bladder, or the skin surface of the perineum. On the other hand, fistulæ may be the result of perforating rectal or vesical ulcers, and cases have been reported in which the fistula has its origin in a broken-down tuberculous Fallopian tube. These fistulæ are peculiar only in the fact that they are lined by the tuberculous membrane.

Symptoms.—The symptoms of tuberculous vaginitis are, as a rule, masked by those of the tuberculous disease existing in other parts of the body. A leucorrhœa associated with painful coitus or pain in using the douche tube will usually be the first symptom that brings the patient to the physician for examination, or the symptoms of a vesico-recto-

vaginal or urethro-vaginal fistula may be the first that are referred to the vagina. A physical examination will reveal one or many sensitive ulcers possessing the above-named characteristics.

The *diagnosis* of the miliary form from granular vaginitis should not present great difficulties when we remember the frequency of the latter as compared to the condition under discussion, also its usual association with pregnancy and gonorrhœa. Furthermore, the character of the ulceration, and the fact that a tuberculous lesion of the vagina is almost invariably associated with a similar lesion elsewhere in the body, will prevent confusion. A chancre can be easily distinguished from a tuberculous ulcer by its history and clinical course; the papular or ulcerative syphilides by the history, the total lack of pain, and mainly by their disappearance under antisyphiltic treatment. The reports of many of the recorded cases state that the patient was first subjected to antisyphilitic treatment, leading to the impression that this confusion often arises. Finally, the secretion of every persistent ulceration of the vagina or vulva should be subjected to bacterial examination in smear or culture preparations, or inoculated into the peritoneal cavity of guinea-pigs. The number of bacilli is often too few for easy demonstration by ordinary staining methods, yet it will cause a tuberculous peritonitis in the guinea-pig in from three to four weeks when present in very small numbers. A microscopic examination of a snipping from the edge of the ulcer may be necessary to distinguish the condition from carcinoma.

The *treatment* of tuberculous vaginitis should be as radical as possible when the lesion can be demonstrated to be a primary one, either in the genital tract or in the body; but it must be remembered that the condition is usually secondary to a much more serious tuberculous involvement of the Fallopian tubes, the uterus, the intestine, or the lungs. In these cases palliative measures alone are indicated. When complete excision of the ulcers is possible this should be done, but we must very often limit ourselves to a thorough curetting and cauterizing of the ulcer, and a prompt treatment of every point of recurrence. Palliative measures will consist in local applications to the ulcers, the repair or cleaning of fistulæ, the maintenance of an antiseptic condition by the use of astringent and antiseptic douches, the use of general tonics—in fact, the use of those measures which are applicable to tuberculosis in other parts of the body.

Erysipelas of the external genital organs, and particularly infection of the genital tract by the *Streptococcus erysipelatos* (*Streptococcus pyogenes*), are occurrences of tragic importance. When the infection is strictly local, the streptococcus finding ingress through some abrasion in the epithelium, the resulting phenomena are those of erysipelas involving the pudendal structures. The virus, once admitted to the field of propagation, spreads rapidly through the lymph capillaries of the surrounding skin. The *symptoms* that ensue are sudden attack of febrile disturbance ushered in by a rigor; the tongue becomes coated, there is

a sense of depression over the stomach, and malaise, with possible nocturnal delirium; swelling of the infected point occurs, associated sooner or later with generally coincident tenderness in the inguinal lymphatics. The swelling in the vulva progresses rapidly and is associated with pain, throbbing, and a sense of heat and dryness; itching is generally an early and persistent symptom, while diffuse infiltration occasioning œdema of the cellular tissue of the vulva rapidly supervenes. Minute vesicles may be discovered, usually arranged in groups, and manifesting themselves in the surface of the skin. The smaller of these vesicles commonly rupture, the resulting discharge of clear or slightly yellowish serum, occasionally tinged with blood, desiccates, and forms crusts. The characteristic feature of this inflammation is to spread rapidly from the point of primary infection. This extension may occur until it involves not only the pudendal structure, lower part of the abdomen, and the inner aspect of the thighs, but it may extend upward into the vagina; it may, indeed, assume the type of "wandering" erysipelas, and invade practically the entire surface of the body before it is arrested. The subcutaneous infection may result in the formation of foci of suppuration, manifesting themselves on the surface of the skin in the form of large purulent blebs, or, if more deeply seated, as fluctuating masses. The *treatment* should be both local and constitutional. Of the local remedies, carbolic acid in solution with liquid vaseline painted on the surface with a soft brush has the merit of being both convenient and effective. While the disease is yet limited to the vulva, a 5-per-cent solution may be employed; but when the infection involves a greater area a solution of not more than 1 per cent should be used. Creolin and phenol are really but milder forms of the same treatment. Concentrated solutions of salicylic acid and of sulphocarbolate of soda, respectively, have been employed subcutaneously around the circumference of the infected area. Comfort is derived from any soft soothing application which will protect the inflamed surface from the air. Silk saturated with carbolized liquid vaseline or with carbolized vegetable oils is a source of comfort, care being taken to maintain, as nearly as possible, an equable temperature in the parts. When suppurations occur they should be freely incised, the cavities being treated antiseptically.

Erysipelas as a source of puerperal infection was first recognised by Dr. Oliver Wendell Holmes, his conclusion being based upon the occurrence of a number of deaths from puerperal fever in the practice of a physician whose finger was known to have been infected while making an autopsy of an erysipelatous subject. The conclusion thus arrived at by the Autocrat of the Breakfast Table has since been confirmed by the clinical experience of the world. The organism of erysipelas, isolated by Fehleisen, was demonstrated by Clivio and Monti in cases of puerperal peritonitis. (See Streptococcus Erysipelatos, *ante*.) The clinical phenomena produced by this special micro-organism while the infection is limited to the vulva and vagina are not known, for the

reason that, in puerperal cases, the occurrence of this infection is not detected until it has invaded the endometrium, at which time it is readily demonstrable in the lochia. As the ensuing essential clinical phenomena are manifested in connection with endometritis, and as the treatment of this infection depends upon the successful treatment of an infectious endometritis, the reader is referred to the chapter on that subject.

Diphtheria of the External Genital Organs.—The inner surfaces of the vulva and vagina are sometimes the seat of active diphtheritic infection, which may be either (*a*) primary or (*b*) secondary. The latter form, in which the genital manifestation of the disease occurs secondarily to its appearance either in the upper air-passages or other loci, is the more frequent. Leick, of Greifswald, reported a case of primary diphtheria involving the inner aspects of the labia and extending into the vagina, the characteristic exudate yielding the Klebs-Loeffler bacillus. Elsner has recorded a case of primary infection of the vagina, by the same bacillus, in a puerperal case. Infection of the vulva by the diphtheria bacillus, whether primary or secondary, in very young subjects may cause noma, or circumscribed gangrene of some part of the vulvar structure.

The *symptoms* of diphtheria of the vulva and vagina consist of an initial chill followed by fever of 105° F. or more, rapid but feeble pulse, prostration—less marked, however, than when the disease attacks the respiratory passages—local tenderness, referable to the vulva or vagina or both, which, upon inspection, reveals the characteristic pearly exudate. The absolute *diagnosis* depends upon the demonstration of the Klebs-Loeffler bacillus.

The *treatment* is both constitutional and topical. Constitutional treatment consists in the employment of the antitoxine; the complete disappearance of the membrane has been noticed in sixty hours following the use of two thousand units of antitoxine. When the local infection is so virulent as to cause noma or circumscribed gangrene of the external structures, hot antiseptic applications should be made and the sphacelus, as soon as well defined, should be removed, every principle of antisepsis being observed in the subsequent treatment.

Aphthæ, or thrush, is a species of infection that frequently involves the vulva and vagina, particularly in nursing women. It depends for its occurrence on the *Oidium albicans*, a vegetative organism that frequently infests the mouths of children. Its appearance in the external genital organs does not differ materially from that in the infant's mouth. Infection occurs in discrete areas elevated with an inflammatory base and covered by a milky white exudate. It causes some local pain with but trifling constitutional disturbance. The treatment consists in thoroughly cleansing the part with sterilized water, applying, subsequently, a strong mercuric bichloride solution, followed by a tampon saturated with boroglyceride. The treatment should be repeated daily for two or three days.

Aerogenous Infection of the Genital Organs.—Suppuration attended with gas formation has long been recognised. Rosenbach studied these phlegmons as they occur in different parts of the body and described what he designated as the " emphysema-bacillus," which he isolated on cover-slip preparations. Arloing described a gaseous panophthalmitis of traumatic origin. Levy, in 1891, isolated a short, fine, nonmobile bacillus from gas-bearing pus of a pelvic abscess. Other investigations have been made by William Koch, Kitasato, Wicklein, Chiari, and Fränkel, the last named of whom isolated, from gas-producing pus, a short, plump, nonmobile bacillus with rounded ends to which he gave the name *Bacillus phlegmonis emphysematosus.* While to Fränkel credit must be given for originality, priority of discovery must be given to Welch and Nuttall (*Medical News,* September 24, 1892), who isolated the organism which now stands in the literature by the name they gave it—viz., the *Bacillus aerogenes capsulatus.*

Infection of the vagina, manifestly due to a gas former, was first described by Braun (*Zeitschrift für Gesammte der Aerzt im Wien,* 1861). The infection manifests itself by the formation of cysts, or, more properly, air vesicles on the surface of the vagina and on the external mucous membrane of the cervix. These vesicles are close set, glistening, and vary in size from a millet to a hemp seed. When punctured, as a rule, nothing but air escapes from them; in a few cases, however, the cysts have yielded a slight amount of pale yellow nonviscid fluid. Of twenty-one cases collected by Herman, seventeen were in pregnant women. Zweifel (*Archiv für Gynäkologie*) analyzed the gas from these vesicles and found it to be trimethylamine. He made his tests by cleansing the vagina and then filling the speculum with test solutions under cover of which the vesicles were punctured. In this way he was able to eliminate ammonia, carbonic acid, coal gas, and hydric sulphide. The smell suggested the latter in small quantities. The odour was peculiarly like that of the plant *Chenopodium vulvaria,* which is due to trimethylamine. The *treatment* of this form of infection consists in puncturing the vesicles as they appear and washing their cavities and the vagina with antiseptic solutions. The vesicles show no disposition to return after being once punctured.

Bilharzia of the vagina depends for its existence upon infection of that canal by the *Distoma hæmatobium* of Bilharz, an organism belonging to the genus of distomatous parasites (Cobbold), and is a cylindrical worm of the order *Trematoda.* The male is about half an inch long and the female is a little longer and more slender. It abounds in Africa, and when infecting the system it is generally found in the portal vessels, and in the veins of the mesentery and of the urinary tract, causing profound constitutional disturbances, hematuria, anæmia, and diarrhœa, being among the more prominent symptoms. This parasite generally affects men who work in water, and, in the majority of cases, produces serious local disturbances in the mucous membrane of the bladder, where it causes single or grouped excrescences, not unlike con-

dylomata, with or without pedicles, and varying both in shape and size. The mucous membrane is thickened and the submucous connective tissue is hypertrophied; the capillaries are dilated, in some instances being changed into cavities which contain full-grown specimens of the distoma. In the interior of these excrescences numerous ova are found. It is not surprising that an organism which infests the urinary tract of men should find its way into the vagina; and infections of that canal by this parasite are of occasional occurrence. The mucous membrane becomes greatly hypertrophied owing to papillomatous developments, the excrescences on the interior of the vagina being numerous and flat-topped, and divided by distinct depressions, while occasionally one of them may become large and pedunculated. The treatment consists in excising the excrescences, cauterizing their base, and treating the wounded surface with bichloride douches. It may be necessary, in removing the larger growths, to incise the mucous membrane so deeply as to render essential the closure of the wound by sutures.

Chancroid, or soft chancre, is a local, contagious ulcer, which is not followed by infectious, constitutional symptoms. It occurs as the result of inoculation from another chancroid and is inflammatory in character, with destructive characteristics which never produce syphilitic or other systemic infection. It sometimes, however, causes inflammation of neighbouring lymphatic glands, resulting in their suppuration—a condition called *chancroidal bubo.* It sometimes becomes serpiginous, spreading from its original place to the different parts of the pudendum, or even to the abdominal walls; or it may become very destructive, a condition designated *phagedenic chancroid.* Chancroid is usually met with in the lowest class of society, where ignorance and filth are found together. It is essentially a venereal disease, as it is transmitted chiefly, if not exclusively, by the act of sexual intercourse. The secretion of the chancroid, or the pus of the chancroidal bubo, is the carrier of the contagium. It has been demonstrated that the contagious germs of a soft chancre are contained in the lymphoid bodies or in the pus cells, inasmuch as the inoculation by filtered serum derived from these sources produces only negative results.

One of the characteristics of chancroid is its self-inoculability, by which is meant that one surface primarily inoculated will, in turn, inoculate another surface with which it lies in contact. Immunity from such self-inoculation is never acquired. The communication of the infection from one surface to another requires the pre-existence of an abrasion, excoriation, or small fissure, through which the virus finds its entrance into the derma. In some cases the infectious element finds its way into the ducts of the excretory glands or into the hair follicles, producing round ulcers, called *follicular ulcers,* which indicate the channels through which the virus entered. Mediate contagion is more rare in chancroid than in syphilis. Any article, such as clothing or the seat of a water-closet soiled with purulent secretions from chancroids, it is said, may communicate the conta-

gion, but Ravogli has never met a case in which he could verify this theory.

Soft chancres may be found in women primarily at the ostium vaginæ, on the fourchette, the vestibule, the clitoris, the labia majora, the labia minora, the perineum, the inner surface of the thighs, the two lower quadrants of the abdomen, and around and within the margins of the anus; and they appear, secondarily, by self-infection, upon proximal surfaces, and wherever the infection may be carried to a break in the protecting epithelium. On the labia they are generally associated with follicular abscesses, œdema, and frequently with extensive destruction of tissue. Purulent secretion drying upon the surface occasions an eczematous appearance. The terms exulcerous, follicular, acneform, eczematous, erythematous, serpiginous, and phagedenic, have been applied to chancroids to distinguish obvious physical or clinical characteristics.

The *prevalence* of chancroids varies in different localities, being more common in cities on the seashore than in those inland; and they are more prevalent in the crowded quarters than in the less densely populated districts. Robert W. Taylor states that the examination of the *puellæ publicæ* revealed the greater prevalence of chancroids among the women of the lowest grades, while there was relatively a greater prevalence of hard chancre among prostitutes who were better conditioned. Ravogli states that relatively few cases of soft chancre occur, annually, in his service at the Cincinnati Hospital, while they are very rare in his private practice. He finds, also, that in private practice they are liable to be of the mixed type. After a few weeks, instead of cicatrizing they become hard and syphilis follows, and for this reason he is cautious in giving an early diagnosis, particularly in the case of young subjects. Ravogli does not accept the theory that chancroids may be the result of pus from any other form of ulceration associated with lack of cleanliness; nor does he believe that chancroid is caused by syphilis; but he concedes the possibility of mixed infection.

The *course* of an ordinary chancroid covers a period of from two to three weeks, the time, however, being influenced by the habits and treatment of the patient. Lack of cleanliness, walking, and alcoholic drinks, prolong the period. Tissue destruction is less extensive and less rapid on the skin than on the mucous membrane. After the chancroid reaches a certain point, there is manifested a spontaneous tendency to repair. The inflammatory halo begins to fade, the œdema disappears, the grayish pseudomembrane at the bottom of the ulcer sloughs off, revealing abundant healthy granulations. The purulent secretion becomes thicker and of good colour. A ring of epithelium forms round the edges of the sore, gradually encroaching upon its centre, until it disappears under a film of newly formed scar tissue. At this point, or, at least, when near recovery, these ulcers may redevelop, manifesting all their original symptoms, the

relapse being caused by coitus, alcohol, or uncleanliness. The apparently healed ulcers may retain their contagiousness for a long time, and be capable of transmitting a disease.

Bacteriology.—Ducrey discovered constant bacterial elements in chancroidal pus. He found in a series of inoculations of chancroid in man, that many microbes, originally in the pus, disappeared from it, but that a peculiar microbe remained constant and abundant so long as the pus retained its virulence. His observations were supported by those of Unna, Kneftning, and others, all agreeing on the identity of this micro-organism. Ducrey found it in chancroidal pus, and Unna detected it in the infected tissues. It is a rodlike bacillus, from 1.5 to 2 μ in length, and from 0.3 to 1 μ in breadth, with rounded ends. It has a tendency to form chains (strepto-bacillus) and to become agglomerated in masses. In the pus it occurs singly, but in the tissues it is always in chain form. It has been found almost constantly in chancroid; it is stained by carbolic-fuchsin, and by gentian violet, and is decolourized by Gram's method. Although it is a pus bacillus it is characteristic of soft chancre, because it has not been found under other conditions.

Pathology.—Chancroidal virus begins its activity as soon as it finds an infection atrium, through which it gains access into the subepithelial layer; the ulceration on the surface of the skin appears later, but is more rapid in development on the vaginal mucosa. As a rule the virus manifests its activity by developing within from twenty-four to forty-eight hours a small pustule, surrounded by an intensely red inflammatory halo. This stage, especially in the mucous membrane, is soon replaced by the characteristic ulceration, round or oval in shape, according to the conformation of the parts; thus, when developed within a fold, it may take on a linear appearance, while on the inner aspects of the labia majora the ulcers may coalesce and become irregular. But wherever the chancroid occurs, or whatever its shape, the edges are sharply cut as if the disk could be readily punched out. The bottom of a chancroid is uneven, and, in the beginning, is covered with a kind of diphtheroid membrane consisting of necrotic tissue. The ulcer exudes abundant, thin, purulent secretion, sometimes of a rusty colour; the underlying cellular tissue is sometimes œdematous—particularly when the inflammation is intense, in which case the soft chancre manifests firmer consistence when taken between the fingers, which fact must not mislead the practitioner into mistaking the case for one of syphilis.

The *diagnosis* of chancroids may be confusing in the earlier stages. They may then be mistaken for herpes, but the difference will be detectable by a careful examination of the lesions. Vesicles, a nonulcerated surface even when broken, smooth edges, and the coalescence of vesicles, are features of herpes. Sometimes chancroids are mistaken for syphilitic mucous patches; the development, size, induration, peculiar colour, elevation of the edges, and symptoms of

syphilis, will, however, enable physicians to distinguish between the two conditions. If doubt still remains, recourse may be had to the crucial test of self-inoculation.

The *prognosis* of chancroids is less favourable in women than in men. The conformation of the parts, the difficulty of cleansing them and of retaining dressings, the presence of urine and of the menstrual fluid, are all barriers to a speedy cure. Suppurative adenitis or buboes prolong the treatment. Phagedæna, fortunately rare, is generally promptly overcome. In cases occurring in drunkards of lowered vitality, a guarded prognosis should be given.

The *treatment*, to be effective, must be based upon the principle of cleanliness. Ravogli secures this in his hospital service by having the parts washed three times a day with hydrogen peroxide, dusted with iodoform powder, and covered with iodoform gauze. Cure is generally very prompt and free from complications, no buboes having developed in his wards. In rapidly progressive chancroids, cauterization by carbolic acid or nitric acid should be practised. The surface should be first rendered insensitive with a 5-per-cent solution of cocaine hydrochloride. Care should be taken to protect the neighbouring parts from the action of the caustics. The use of carbolic acid is followed by a little secretion, and is less painful than nitric acid which causes sharp inflammatory reaction. After cauterization the ulcer is treated like any other granulating surface. Iodoform in private practice is objectionable because of its odour. Iodol, europhen, bismuth subiodide, have all been tried and discarded by Ravogli, who still uses aristol but deems it inferior to iodoform. Gaylord has used with success a 10- to 40-per-cent solution of formalin as an escharotic. Strong applications of this kind, however, have been generally abandoned since the advent of iodoform. A 6- to 8-per-cent solution of sulphate of copper stimulates granulation. If the ulcer is sluggish in healing, it may be curetted. A well-regulated diet, improved hygiene, stimulants and tonics, are indicated in old run-down cases. Opiates are sometimes needed for pain, although hot water containing a little potassium permanganate or mercury bichloride, used in compresses, may be sufficient to allay the pain and to change an unhealthy to a healthy surface.

Hard chancres in women are very frequent, their course is irregular, and their diagnosis sometimes difficult. In some cases the chancre is so small and ephemeral that it is often overlooked; in others it is very pronounced, but on account of the associated inflammatory conditions, its exact nature is more or less obscured. In women, the characteristic induration of chancre is less pronounced than in men; occasionally, when located around the fourchette, it produces a hard thick cicatrix which may last for many months. The examination of the genitalia in women is sometimes difficult on account of the conformation of the parts, although in all cases it should be made with thoroughness. Chancres may be single or multiple, only one

being found in the majority of cases. For clinical purposes, chancres in women have been divided into (1) superficial or chancrous erosion; (2) scaling papule; (3) elevated papule, or *ulcus elevatum;* (4) incrusted chancre; (5) indurated nodules; (6) diffused exulcerated chancre.

(1) *Superficial, or chancrous erosion* is the form most frequently met with in women. It is difficult to recognise in its earliest stages; it is always found on the surface of the mucous membrane, beginning as a red spot somewhat deeper in colour than the mucous membrane itself. It is liable to pass without notice, so that when first seen by the physician it is already deprived of its epithelium and manifests incipient ulceration. When it is seated on smooth surfaces like the labia it is easily recognised, but when it is on the fourchette or within the ostium vaginæ it is not easily discovered. The chancre is of red colour, round, with a smooth surface, from which oozes a thin serous secretion that assumes the appearance of true pus only in the presence of active inflammation. In these chancres, the induration is only superficial, of that kind which Fornia called *chancre parcheminé.* The diagnosis of this form of chancre is not difficult when due attention is given to the foregoing appearances. The exact character of the trouble is established in the course of a few days when the lymphatic glands of the groin become involved. The course of this kind of chancre is rather short; it undergoes speedy involution, which accounts for the fact that constitutional symptoms of syphilis are manifested in some women in whom we are not able to find the initial sore. In many cases, however, after the disappearance of the chancre, there remains on the area that it occupied, a kind of red spot, very persistent, and lasting at times for months. This chancrous erosion, especially when located on the vulvar lips, produces a kind of chronic œdema of the underlying tissues, and sometimes of all the pudendal structures; it lasts frequently after the chancre has completely healed. When the primary ulcer is seated on the fourchette it assumes the typical induration of a hard chancre, presenting a raw-beef appearance characteristic of the initial syphilitic lesion. (2) The *scaling papule* may appear on the skin of the labia majora and of the labia minora as the initial syphilitic lesion. It is a small, dull-reddish papule, slightly elevated. It develops into an elevation of the skin, has a purplish brown colour, sharply defined edges, and in size varies from that of a split pea to that of a quarter of a dollar. It is round or oval according to the shape of the parts where it is located, and is firm, hard, and resistant to the touch. It is usually single, sometimes double, and gradually loses its epithelium, becoming ulcerated and incrusted, when it is called an ecthymatous chancre. (3) The *elevated papule*, or *ulcus elevatum*, begins as a chancrous erosion with hyperplastic infiltration, and grows to a considerable size. It is round or oval, deep red in colour, and has a smooth, velvety surface, flat or concave with distinctly elevated edges, and discharges a thin serous fluid. Irritation from walking

or from uncleanliness may provoke inflammation, causing a pronounced œdema of the labium on which it is seated. Careful palpation will reveal a slight induration, parchmentlike in character. This condition is essentially chronic, lasting many weeks, resolving slowly, leaving a deep red spot which is replaced by a scar. (4) *Incrusted chancre* affects the cutaneous surface of the pudendum, beginning as a chancrous erosion or as an indurated nodule, and speedily developing a kind of film of a light, greenish, creamy tint, or, at other times, of a brownish red necrotic character. (5) The *indurated nodule* is rather rare in women and is found where the skin and mucous membrane join each other. It manifests itself as a sharply circumscribed mass of indurated tissue with a narrow base and sloping edges. (6) The *diffiused exulcerated chancre* is found in women of the lower class; it begins as a chancrous erosion, grows to an *ulcus elevatum*, and then spreads over an extensive area. It has an ulcerated and uneven surface, deep red in colour, but only slightly painful, although frequently associated with œdema of the part on which it is developed.

The *bacterial* origin of syphilis, although very probable, has not been demonstrated. The analogy between syphilis and other diseases of known bacterial origin prompts the belief that the various phenomena of the disease depend upon a bacillus, not yet isolated, and its toxines.

The *pathologic changes* occurring in indurated chancre are of an inflammatory character, and are accompanied in any stage of syphilis with a persistent involvement of the blood vessels; an infiltration of small round cells associated with those of larger size, and polyhedral in form, occurs in the meshes of the connective tissue surrounding the blood vessels. There is a constant tendency to the production of new connective tissue, especially in the initial chancre, and again in the later tertiary stage as manifested in the nervous system. The perivascular changes and the infiltration of the tissues beyond the chancre are the most important features of the initial sore. The lymph spaces are readily affected with the peculiar infiltration, the virus speedily travelling through this channel to the inguinal glands. The peripheral perivascular lymph spaces are infected by the time the chancre makes its appearance; and the first halt in the march of the virus is shown by the swelling and induration of the inguinal glands. Microscopically, a well-developed chancre reveals a seminecrotic mass of small spheroidal cells which constitute the bulk of the ulcer, circumvallated by a zone of œdema and a cellular infiltration of the papillary layer of the derma. This œdema acts as a wall to protect the surrounding healthy tissues from invasion. The virus, having entered the lymphatics, passes from one gland to another until it reaches the general circulation. This occurrence marks the transition from the secondary, or incubation period, and the disease breaks out in the ordinary form of roseola with all the accompanying symptoms of chlorosis, neuralgia, syphilitic fever, etc.

The female genitals, like any other part of the integument, may

show every kind of eruption which results from the two morbid processes of hyperæmia and infiltration. The hyperæmia is mostly found in the early period of syphilis in the erythematous syphilides; the infiltration is always more advanced in the later stages. In the early eruptions, however, a slight cell infiltration is always present, giving rise to patches and nodules. In this stage of syphilis, Ravogli has repeatedly found a kind of infiltration of the skin of the labia majora and labia minora, just at their free edges, showing the epidermis slightly abraded and intermingled with superficial erosions; besides this slight thickening of the skin, the patches show a kind of dirty yellowish colour, and are accompanied with itching. *Mucous patches* or *condylomata lata*, are quite often found on the external genitals of women, during the first two years of the course of syphilis; this eruption is characteristic of syphilis, and when discovered settles all doubt relative to the diagnosis. Mucous patches, on account of their abundant secretion, are the most dangerous eruption for the transmission of syphilis. Ravogli is of the opinion that most cases of syphilis are communicated by mucous patches. They are found on the mucous membranes and on proximal surfaces of the skin which are continually moistened by perspiration. They begin on the skin as flat elevations, circular or discoid in form, and of different sizes, showing a depression in the centre with elevated borders; the epidermis in the centre is macerated by the moisture and is transformed into a grayish pellicle. This is soon cast off, leaving a plaque of a raw flesh-coloured appearance. This plaque secretes abundant serum, which soon becomes altered and causes an offensive smell, and by irritating the skin induces intertrigo. Ravogli has observed a kind of contagiousness in these patches, manifested by the development of similar lesions on proximal cutaneous or mucous surfaces. They assume a variety of appearances, according to location and the local conditions to which they are subjected. On account of the presence of urine, perspiration, etc., they may develop superficial ulceration, manifested by an abundance of offensive, purulent secretion. As a result of persistent irritation, the patches may become uneven with a verrucous aspect, caused by hypertrophy of the papillæ of the derma, a hypertrophy which sometimes assumes a vegetating character (*condylomata lata*). These different appearances of mucous patches have caused authors to classify them as diphtheroid, ulcerative, vegetative, or hypertrophic. They are either round or oval in shape, according to the part upon which they are located; sometimes they appear like ulcerated *rhagades* around the ostium vaginæ or between the anal folds. On the mucous membranes, mucous patches have a kind of grayish appearance with marked edges slightly excoriated in the centre. The chronological period of mucous patches is the secondary stage from its beginning to its end. Ravogli (*Monatshefte für praktische Dermatologie*, 1893) observes that it is not rare to see patches on the tongue and in the mouth of syphilitic patients after four or five years following the primary infection, and

in patients who are already manifesting tertiary symptoms. These lesions are sometimes the most stubborn manifestations of syphilis, as they show a tendency to frequent recurrence. When not properly treated, they may become hypertrophic, forming papillomatous masses which may persist for a long time. They usually disappear by a process of superficial ulceration and without leaving a scar. The anatomopathologic lesions of mucous patches consist in hypertrophy of the papillæ, and in abundant infiltration of cells throughout the papillary layer and the corium. The mucous layer of the epidermis is also affected, showing a proliferation of the cells, and a granular change of their protoplasm that gives to the cells a peculiar appearance. In the ulcerated patches this becomes obscure. On account of the dusky appearance of the infiltrated papillæ, the mucous layer in many points being absent, and the tips of the papillæ mutilated by the ulcerative process, mucous patches when once seen and identified will always be recognised. There can be no doubt that they are an exclusive form of constitutional syphilis.

We have already spoken of the acuminated condylomata, which are nonsyphilitic manifestations, and we have pointed out the characteristics which distinguish them from the condylomata, or mucous patches. It is possible to make a mistake only in cases of hypertrophic or vegetative mucous patches, but the absence of the pedicles, the characteristic ulceration, the abundant sero-purulent secretion, and the accompanying antisyphilitic symptoms, should be sufficient points of difference to establish the true diagnosis.

Treatment.—It is beyond doubt that in order properly to treat mucous patches, a general antisyphilitic treatment must be administered. The choice of the antisyphilitic remedies is subject to the condition of the patient, to the period of syphilis, and so forth; and it would be entirely out of place to enter here into such a difficult and intricate question. The mucous patches require local treatment. Local treatment in a great many cases consists in the observance of the rules of cleanliness. The best treatment, in Ravogli's opinion, for mucous patches, is to wash the surface well with an antisyphilitic solution of mercury bichloride, 1 to 2,000, and, after a while, to dry and powder them with calomel. In some cases the mucous patches are extremely stubborn, with a tendency to ulceration and hypertrophy, and in these cases it is necessary to use caustics. The application of a 4-per-cent solution of acid nitrate of mercury produces a superficial cauterization, and we may be sure that after touching the mucous patches two or three times with this solution they will readily heal. Sometimes the mucous patches resist the application of the solution of acid nitrate of mercury, and in these cases it is necessary to resort to stronger caustics; then, nitric acid in full strength is useful for the destruction of these patches. The application of salves or plasters to mucous patches is not to be recommended, because they are found where the skin forms folds and is macerated by the per-

spiration; it is better, therefore, to use antiseptic bathing and the application of dry powder, which will prevent the accumulation of the perspiration.

Late Syphilitic Ulcers of the Female Genitals.—Syphilitic ulcers of the vulva were studied in 1849 by Huguier, in his article on *Ésthiomène*, or *Dartre Rongeante de la région vulvo anale*, Paris, 1849, and by Matthews Duncan in the *Edinburgh Medical Journal*, July, 1884. In the venereal ward of the Cincinnati Hospital, Ravogli has had occasion to observe a great many cases of extensive and deep ulcers of the vulva in dissolute women who have been admitted into that institution. He supports the opinion of Hyde in denying that those ulcers of the vulva have anything to do with lupus vulgaris, and thinks that there can be no doubt that the women have been affected with syphilis. He admits that the extreme destruction of the external genitals of women which are occasionally observed may be due, not to syphilis alone, but probably to syphilis in connection with tuberculosis; and he remembers one case in his service in which a large and deep ulcer had destroyed part of the labia minora and part of the entrance of the vagina. The woman died, and at the post-mortem the perineum was found to be studded with tubercles. Usually, these ulcers are found in weak patients, with a system run down from misery and debauchery. The ulcers are always seated on a strong and thick induration which is confined to one or both labia. This infiltration sometimes extends to the mons veneris, and may also spread downward to the perineal tissues. It is accompanied by a kind of hypertrophy which is felt deeply situated in all the tissues. On these indurated places, ulcers are found which are deep and destructive. One or both labia may be destroyed. Sometimes, when the ulceration affects the perineum, the destruction may extend to the anus producing alteration of its function. The edges of these ulcers slope to the bottom, which is red or grayish from necrotic detritus, without a tendency to the formation of healthy granulations. The destruction once begun goes on very rapidly, and it is a difficult task to stop its ravages. Says Ravogli: "In my experience I have found this form of vulvar syphilitic ulcers more frequent in the negro race than in the white race. The date of infection from syphilis was from six to twelve years. No enlarged glands could be found in the groins or in the cervical region, yet, in many of these women, deep scars could be found on the legs, witnesses of progressed gummata, and roughness of the tibia could be found, showing progressed specific periostitis. These ulcers are the result of late syphilis. They are the result of gummatous infiltration, but there is no doubt that the general condition of these patients has a great deal to do with the virulence of syphilis."

The *prognosis* of these ulcers must be given with great reserve. There are two principal elements for the production of the ulcers: First, advanced malignant syphilis; secondly, weakness of the general system.

The *treatment* consists, first, in improving the general system with good diet, tonics, and better surroundings. Antisyphilitic treatment consists mostly in the administration of potassium or sodium iodide. Mercurials can scarcely be recommended on account of the weak and poor condition of the patients. Beneficial results follow applications of a solution of mercury bichloride, 1 to 2,000, and then covering the ulcerated and infiltrated surface with the emplastrum hydrargyri, which, producing an abundant suppuration, in a short time causes a sloughing out of all the detritus from the bottom of the ulcers. In the same way, the application of the emplastrum hydrargyri helps a great deal toward the absorption of the infiltration and œdema which form the base of these vulvar syphilitic ulcers. The washing with peroxide of hydrogen and the application of powdered iodoform have also given very good results, but only in later stages, when the emplastrum hydrargyri had already diminished the infiltration. The curette has been used in cases where the surface has been covered with abundant ill-natured granulations. But with this exception, there is but little need for the curetting of such ulcers. The application of strong caustics, such as nitric acid and the actual cautery, has been tried only in those cases in which the destructive process had taken wide proportions. It is seldom necessary to resort to these means, particularly when good results are realized by the emplastrum hydrargyri.

CHAPTER XVII

DISEASES OF THE SKIN OF THE FEMALE GENITALS

Intertrigo—Erythema—Œdema—Eczema—Folliculitis—Herpes progenitalis—Pruritus—Parasitic affections—Atrophy (Kraurosis)—Vulvar adhesions.

The skin of the genitals of the woman is subject to all the diseases that are met with in the general integument, and, on account of their anatomical structure and position, some affections are more frequently found here than in other regions.

Intertrigo.—This common affection is usually found in fleshy women. It is produced by the apposition of the surfaces of the skin of the thighs with each other and with the external portion of the labia majora, and is a result of friction. Under these circumstances perspiration is very abundant, and it macerates the epidermis and causes an inflammation of the skin, which in the beginning is limited to the degree of a simple erythema, but, continuing, reaches the degree of a true eczema. Indeed, in the beginning, the surface of the inguino-crural fold and of the labia is red and moist, and the epidermis appears slightly macerated. An itching and burning sensation is associated with the affection. If promptly treated the skin returns to the normal condition in a short time. If the affection is allowed to continue, then, on account of the profuse perspiration and of its chemical changes, associated with impurities and uncleanliness, the epidermis is deeply macerated, the surface is excoriated, oozing a serum which starches the linen, and the patient can scarcely move on account of the pain produced by the motion on the inflamed skin. Although the affection is called *eczema intertrigo*, Ravogli does not consider it a true eczema. Eczema may be the consequence of the intertrigo, just as it may follow any other irritation of the skin.

Vulvar intertrigo is *caused* by gonorrhœa, syphilis, or the accumulation of nonspecific but irritating secretions, in the cutaneous folds of the pudenda and groins. The large quantity of sero-purulent secretion oozing out of the vagina in cases of gonorrhœa, moistens the skin of the genitals and of the thighs, and by its irritating qualities causes intertriginous eruption. This intertrigo is also found in patients who observe strict cleanliness. In women neglectful of the principles of hygiene the intertrigo assumes a much more aggravated form. In the first case the affection is limited to the front part of the genitals, labia majora, labia minora, and clitoris with its prepuce, as a result of

the contact of the gonorrhœal fluid on the skin. In the second case intertrigo is spread more on the internal surface of the thighs and of the labia majora in the fossa genito-cruralis, in consequence, not merely of the presence of the purulent secretion, but also of the friction of the two surfaces of the skin, which become macerated by the purulent secretion, perspiration, and other impurities. Intertrigo in these cases is acute, the surface of the affected skin is red and somewhat swollen; the epidermis is macerated, giving it a whitish, soggy appearance; abrasions and small rhagades are formed on the labia majora, in an oblique direction toward the fossa genito-cruralis; the surface is always moist from the discharge of serum, which, together with the gonorrhœal secretion and the perspiration, produces an offensive smell. A burning sensation accompanies the course of the affection, and motion makes it so painful that the woman can scarcely walk.

Another form of intertrigo, more chronic in form but occurring under the same circumstances, was recently described by L. Brocq and Léon Bernard (*Annales de dermatologie et de syphiligraphie*, 1899, fasc. 1, 3). It is limited to the genito-crural fossa, and when the woman is placed in the position used for the speculum examination, it appears like a triangle with the base at the fossa and the apex downward on the upper lateral side of the thighs. The skin is of an intensely dark-red colour, showing deep furrows in an oblique direction, and between them follicles can be seen. The pigmentation is very deep, due partly to the inflammatory process and partly to the chromatogenous condition of these regions. A kind of small, flat, papillary growth can be seen on the surface like a lichenization, which is due to a proliferation of the connective tissues in the papillæ with some hypertrophy of the epidermic layers.

The *pathology* of this affection is limited to the epidermis and to the superficial layer of the derma. They are the same as are found in any other inflammatory disease of the skin, hyperæmia, overfilling of the blood vessels, which is the cause of the inflammatory redness, and swelling. In consequence, after increased pressure in the blood vessels, some exudation of serum and of the white corpuscles of the blood takes place through the walls of the blood vessels. The small round inflammatory cells and the white corpuscles of the blood infiltrate the papillary layer, and so increase the nutrition of their connective tissues. The epidermic cells are macerated by the presence of the exudation, and the horny layer is easily detached by the other epidermic layers, and in this way excoriations are formed. On the other hand, when the inflammatory process lasts for a long time the papillæ become infiltrated with cells, and their connective-tissue corpuscles may increase in their nutrition and proliferate, producing small flat papillary warts as a consequence of the irritation.

The *diagnosis* of intertrigo by pathologic alterations from eczema and dermatitis is an impossibility. Ravogli, in reply to the question whether this affection, being of an inflammatory character, is

to be classified as an eczema or a dermatitis, replies: It is a question of degree; it progresses from a pale rose-red colour to a deep reddish-violet colour. From a scarcely perceptible swelling it may attain a thick and pronounced œdematous condition, and in the same way there can be a thin, serous, scanty discharge, while in other cases an abundant, copious discharge exudes, which wets the linen of the patient. He believes, therefore, that the name intertrigo is well adapted. It gives the idea of the affection as the result of the friction of two cutaneous surfaces, and of the possibility of curing it in a short time by preventing the contact of the cutaneous surface. It is of a rather peculiar nature and has to be referred to dermatitis. Intertrigo is also found in syphilitic women, often accompanying the presence of mucous patches in the secondary stage. The secretion oozing from *syphilitic eruptions*, which in that region usually are ulcerated, causes the maceration of the epidermis, and intertrigo is the result. In these cases the first thing to do is to treat the mucous patches, and with cleanliness the intertrigo easily disappears.

In the same way, for the intertrigo accompanying an acute gonorrhœa, the first indication is to treat the gonorrhœa and prevent the gonorrhœal fluid from remaining on the skin of the external genitals. Although cleanliness may be maintained, and the improvement of the acute gonorrhœa be effected, yet the intertrigo left to itself will not heal, and it requires some attention and some local applications in order to bring about recovery.

Treatment.—In intertrigo cleanliness must be observed, so as to remove all impurities from the irritated surfaces of the skin. After washing and drying, the surface is covered with rice powder or starch powder, to which may be added a small quantity of boric or salicylic acid (2 to 100).

When the epidermis is excoriated, the surface is sore and there is a great deal of serous secretion. Ravogli finds of great advantage the use of bathing with some astringent solution. The solution of subacetate of aluminum and lead, known as Burow's solution, 3 per cent, applied on lint, in order to separate the skin surfaces from each other, is very beneficial. If the patient can remain in bed, with a few applications of this solution the intertrigo will easily disappear; but if the patient must attend to her occupations, then bathing may take place morning and evening, and during the day some salve may be applied, such as Wilson's ointment, or an ointment of—

℞ Zinci oxidi, }
Bismuthi subcarbonatis, } ..... āā ℥ss.;
Acidi carbolici ..... gtt. x;
Vaselini ..... ℥j.
M. Fiat unguentum.

This can be rubbed on the surface, and particularly upon the labia majora, which should be kept separated from the thighs by means of soft lint.

In chronic intertrigo with papillary hypertrophy it is necessary to use more active remedies. Two or three applications of Wilkinson's ointment—

℞ Sulphuris sublimati,
Picis liquidæ,
Saponis viridis, ... āā ʒvj;
Terræ albæ ..... ʒiij;
Adipis suis ..... ℥j.
M. Fiat unguentum.

have given good results, for by causing the desquamation of the old epidermis we obtain a new soft epidermis. The application of a resorcin salve can also be recommended.

℞ Resorcini ..... ʒss.;
Acidi salicylici ..... gr. vj;
Vaselini flavi ..... ℥j.
M. Fiat unguentum.

When the epidermis has returned to its normal condition and the serous secretion has stopped, the only way to finish the treatment and prevent any relapses is to use scrupulous cleanliness, and after washing, to dust the genitals and genito-crural region with one of the recommended dusting powders.

Erythema.—The skin of the genitals of the woman is often the seat of erythema, the result of various causes. Obstinate erythema affects the female genitals in consequence of glycosuria, and indeed it is the duty of the physician when he finds cases of erythema localized in the genitals to examine the urine. In these cases the labia minora are red and slightly swollen, the labia majora are red and swollen, the colour is rose-red, of an intense hue, and the epidermis, distended from the scanty exudation of serum, takes on a smooth, silky, and glossy appearance. This erythema sometimes spreads to the internal surface of the thighs, but in the usual cases it remains limited to the genitals. Excoriations are found on the reddened and swollen surface of the skin, produced by the act of scratching, because this glycosuric erythema is often accompanied by a persistent itching sensation—pruritus vulvæ. Pruritius is in these cases very intense, and the patient can not restrain herself from scratching in order to stop this disagreeable itching sensation. This deprives the sufferers of their sleep at night, and the constant scratching irritates the skin so much that it produces a persistent œdema or pustules, and superficial ulcerations.

The presence of sugar in the urine, moistening the mucous membrane and the skin of the genitals, is the *cause* of the erythema. It must not be forgotten, however, that the tissues of glycosuric persons offer a good ground for the development of the pus germs, and as a result they are often troubled with persistent furunculosis.

Treatment.—Although it is difficult to cure this erythema on account of its persistent cause, yet great benefit can be obtained from general and local treatment. For the first object, it is necessary to subject the patient to the ordinary diet of diabetics, by forbidding all amylaceous food and thus diminishing the quantity of sugar in the urine. These dietetic rules must be accompanied by the use of some mild purgative mineral waters, like Carlsbad, Apenta, Hunyadi Janos, Blue Lick, Congress, etc., taken regularly every morning in a dose of from half a glass to one glass, according to the tolerance of the patient. For local treatment the most important rule to follow is cleanliness. The external genitalia and the vagina are to be thoroughly washed with green soap and water and then irrigated with a 2-per-cent solution of carbolic acid. The patient is advised to remain in bed and apply compresses with liniment of oil and limewater, to which may be added from 2 to 4 per cent of ichthyol. When the patient gets up she may make an application of Wilson's salve or the suggested formula of oxide of zinc and subcarbonate of bismuth. Lassar recommends the following formula:

℞ Acidi phenylici ..... 1 to 2 parts;
Hydrargyri sulphidi rubri ..... 1 part;
Sulphuris sublimati ..... 25 parts;
Vaselini Americani ..... 100 "
Olei bergamottæ ..... gtt. xxx.
M. Fiat unguentum.

This mixture, as it contains a great quantity of sulphur, without causing irritation prevents the development of the pus germs which so often occur in the skin of diabetic persons.

Œdema of the vulva may depend upon any of the conditions that interfere with the free circulation of the blood in the vulva, only a few of which are here considered. In cases of œdema of the legs as a consequence of heart disease or of general anasarca, the skin of the genitals of the woman is œdematous, swollen, of a waxy rose-red colour, the labia majora protrude in a round shape, and are sometimes painful on account of the acute distention of the skin. The labia minora and the clitoris are also swollen, presenting the same appearance; the thighs, which are also in an œdematous condition, do not permit the woman to bring the legs close together. There are, however, cases of œdema localized in the genitals of the woman of angeioneurotic origin, as described by Quincke, Jamison, and others. This œdema comes in the form of repeated attacks, which are often preceded by general malaise, vomiting, or diarrhœa. Œdema occurs in the form of a localized swelling of a whitish waxy rose-colour, with a certain brilliancy of the affected skin; it appears in different regions of the body, and the genitals may be included. Ravogli has observed a woman subject to attacks of this affection which could with propriety be called the giant urticaria of Wilson. The swelling in this case was limited to the

right labium, assuming the size of a fist, and it was accompanied by some pain and an itching sensation. It lasted for several hours and then gradually disappeared without leaving any trace. It is easy to understand that the swelling was due to an effusion of serum in the meshes of the connective tissues of the derma and of the subcutaneous tissue, and that the acute œdema was the result of an angeioneurotic affection, as the patient had frequently had similar localized œdema on half of her face and on her left shoulder.

Œdema of the vulva as a result of passive hyperæmia has been observed by Ravogli, in the practice of Fackler, in a case of Raynaud's disease. One of the labia majora was bluish, red, and swollen, with a sloughing patch of superficial gangrene, together with the same asphyctic symptoms in several toes.

Œdema accompanied by stasis sometimes appears in one labium on account of a hard chancre concealed in the internal surface of the labium or in one side of the ostium vaginæ. In this case œdema affects only one labium, which is of a bluish-red hue, showing the location of the obstacle to the circulation. It is scarcely necessary to say that as soon as the chancre begins to heal up the œdema disappears.

Treatment.—In cases of œdema of the genitals accompanying anasarca, the treatment has to be directed to relieve the general condition, but the local disturbance must not be neglected. The application, in the form of compresses, of mild astringent solutions, like Burow's solution in a strength of 3 per cent, or Goulard's lotion, has been found very beneficial. In the same way, when stopping the application of the compresses, the use of dusting powder, as starch or rice powder, with the addition of 3 per cent of boric or salicylic acid, is found of great service. The nurse should apply soft linen pieces between the folds of the skin, thus preventing the surfaces from rubbing each other and causing intertrigo, which often complicates œdema of the vulva.

Eczema of the Vulva.—Like any other part of the body, the skin of the female genitals is subject to eczema in acute and chronic forms. In speaking of intertrigo it was mentioned that, in consequence of the neglect of care and cleanliness, it may be the starting point of an eczema. In the same way, in cases of pruritus vulvæ, the irritation caused on the skin by the continuous rubbing and scratching may be the direct cause of eczema of this region. The propagation of the *Staphylococcus pyogenes albus* on the deeper layers of the skin is to be recognised as the chief causative factor.

Acute eczema may affect the vulva, implicating the labia majora and minora, clitoris, and the mucous membrane of the vagina, spreading along the periphery to the upper portion of the thighs. Along with the burning and itching sensation, a diffused redness and swelling affects the parts mentioned, and presently small vesicles appear, which soon break, causing a discharge of serum, which moistens the linen.

Chronic eczema, however, is the form more often met with when localized upon the female genitals. It often occurs in the form of eczema rubrum, affecting the labia majora, labia minora, and the mucous membrane of the vagina. The labia majora are red, swollen, and infiltrated, and, in consequence, the rima vulvæ is opened by the distention of the labia. On account of the unbearable itching sensation numerous excoriations are produced by the action of scratching and rubbing. In many cases the eczema spreads to the upper portion of the thighs and also to the mons veneris. On account of the spreading of the affection to the vagina, an abundant secretion oozes out of the genitals, which increases the intensity of the affection. In order to be sure that the secretion is not of a venereal origin, Ravogli always makes a microscopic examination of it so as to exclude the possibility of the existence of gonorrhœa.

Eczema of the vulva may, by continuity, very easily spread to the perineum and to the anus. The parts are red, thick, and excoriated, and serum oozes from the excoriations. Sometimes the excoriations are covered with crusts, but where there are opposing surfaces these become more or less glued. At other times no discharge takes place; the skin is rough, dry, and slightly scaly. It is always accompanied by a violent itching sensation, which causes great misery. This form of eczema may be the result of a local irritation, leucorrhœa and gonorrhœa being the most effective factors; or it may be the result of the scratching and tearing of the skin incident to intertrigo. It may also be of reflex origin, or it may be referable to the presence of uterine disorders.

Treatment.—Ravogli has always obtained good results by the application of ichthyol in different formulæ. First, care has to be taken to improve the condition of the vagina by means of irrigations with a solution of biborate of sodium, which the patient will repeat twice a day. Every other day Ravogli inserts into the vagina a tampon saturated with a mixture of 25-per-cent ichthyol in vaseline or glycerine, which the patient will leave in the vagina for twelve hours. Externally he directs the patient to apply for a few minutes a solution of carbolic acid, which relieves the itching sensation and sterilizes the affected skin. The formula which he employs is:

℞ Acidi carbolici ..... ʒj;
Glycerini ..... ʒij;
Alcoholis ..... ℥ij;
Aquæ rosæ ..... ℥iv.
M. Fiat linimentum.

At first the patient complains of some burning sensation, but she is soon willing to repeat the application for the relief which it affords to the itching. After this application the patient is directed to apply pieces of lint well saturated with the following liniment:

℞ Ichthyolis ..... ʒij;
Olei amygdalæ dulcis, }
Aquæ calcis, } ..... āā ʒiv;
Glycerini, }
Aquæ rosæ, } ..... āā ℥j.
M. Fiat linimentum.

The use of salves is to be avoided in this condition, because the abundant secretion, together with the salve, makes rather an irritant mixture.

After the repeated applications of the ichthyol liniment in the manner described, the surface of the skin begins to heal up, the itching sensation greatly diminishes, the swelling and the redness nearly subside, and at this point there may be applied a salve of oxide of zinc, which will finish the treatment. The formula for this salve is:

℞ Zinci oxidi, }
Bismuthi subcarbonatis, } ..... āā ʒss.;
Acidi carbolici ..... gtt. x;
Vaselini flavi ..... ℥j.
M. Fiat unguentum.

When the skin has returned to its normal condition it will retain some redness as the result of the past trouble, for the relief of which Ravogli advises the patient to continue the use of the lotion of carbolic acid twice a day, and, after drying the surface, to dust the skin with an innocent powder, as starch or rice powder, to which some oxide of zinc or subcarbonate of bismuth may be added.

Folliculitis.—Either in consequence of an eczema or without a known cause, an inflammatory process may invade the follicles of the hairs which cover the female genitals. The affection is rather rare, as Ravogli has met with this condition in only two cases, where the female genitals presented the exact appearance of sycosis. It is an inflammatory affection in a subacute or chronic form, affecting the connective tissue of the hair follicles and also of the sebaceous glands connected with them.

Bacteriological studies have recently explained that, like sycosis of the beard, folliculitis may be of double origin, either the result of the fungus of the ringworm or the result of the development of the pus germs in the follicle of the hair. In both cases which Ravogli had occasion to study, the pus cocci were the cause of the disease. In both cases the affection started from a superficial eczema and had developed until the surface gradually became covered with pustules, conical in shape, each one having a hair in the middle.

It is easy to understand how the pus germs find their way into the follicles of the hair. The opening from which the hair passes through the epidermis is lined with epidermic cells, forming a kind of funnel around the shaft of the hair. According to Bockhart, the pus germs

capable of producing this affection are the *Staphylococcus albus, aureus,* and *citreus,* the same that can produce impetigo and furunculosis. On account of an inflammatory process, especially eczema, the germs find the follicular openings more easy of access than in the normal condition, and insinuate themselves into the follicles, thus causing inflammation of the tissues forming the follicle of the hair, and of the surrounding tissues. It will be seen that this is nothing more than a spreading of the process by continuity, when it is remembered that eczema is only the result of the production and development of the *Staphylococcus pyogenes albus* in the layers of the epidermis.

The hair follicle, inflamed and swollen, is converted into a small abscess, as proved by Wertheim. A transudation of serum and white corpuscles of the blood takes place in the hair follicle, producing a hydropic condition of the membranes covering the root of the hair. The root is softened and swollen by sero-purulent infiltration, and in consequence the hair is easily removed, having no adherence. The papilla is usually spared from destruction, and this is the reason why in all cases of sycosis the hair is easily reproduced.

Symptoms.—As in ordinary cases of sycosis, the folliculitis of the female genitals is revealed by the presence of pustules or papulo-pustules, each one being perforated by a hair. The pustules are conical in shape and contain a drop of pus at the point surrounding the shaft of the hair. The skin of the labia majora and of the mons veneris, when affected with folliculitis, is usually red and inflamed. This is accompanied by a burning and itching sensation. This affection is often associated with boils in the same region or in the neighbouring parts of the thighs or abdomen, caused by the inoculation with the staphylococci effected by the finger nails in the act of scratching. This affection of the follicles of the hair of the woman's genitals, although chronic and obstinate, is not so difficult to treat as sycosis of the beard. It may be said that without the necessity of removing the hair, either by shaving or by epilation, this disease can easily be treated, yielding readily in a few weeks to the action of remedies.

Treatment.—Of course the general system should not be neglected, although the disease is a local one. The condition of resistance of the organism to the development of the pus germs is very important, and when we begin the treatment it is necessary to establish a plan of general medication. If the patient is in an anæmic condition, prescribe ferruginous and tonic preparations; if she is suffering from a scrofulous condition, the use of cod-liver oil will be of great advantage. In case the woman is inclined to gout, or if she perspires a great deal, we must prescribe anti-gout remedies, such as lithia, salol, salicylates, etc.

The local treatment consists in enforcing rules of cleanliness. Ravogli uses with good results an application of compresses well saturated in an astringent and antiseptic solution, and frequently repeated; also compresses saturated with a mild solution of bichloride of mercury (1 to 1,000) for half an hour twice a day, followed by the applica-

tion of a salve, such as Wilson's ointment. In more stubborn cases the following formula can be used with good results:

℞ Acidi carbolici ..... gr. v;
Bismuthi subnitratis ..... ʒss.;
Unguenti hydrargyri ammoniati ..... ʒij;
Unguenti aquæ rosæ ..... ʒiv.
M. Fiat unguentum.

The application of ichythol is highly recommended. This is used in liniment form applied on lint, or in the form of salve, 10 per cent, in association with zinc ointment and 2 per cent beta-naphthol.

Salves containing sulphur, from 4 to 6 per cent, are also found very useful. It can be applied in the form of Lassar's paste:

℞ Sulphuris sublimati,
Zinci oxidi,
Amyli oryzæ, } ..... āā ʒj;
Acidi salicylici ..... gr. x;
Vaselini ..... ʒj.
M.

With this treatment and without any necessity of epilating, as in the case of sycosis of the beard, we can obtain good results in a short time.

Herpes Progenitalis.—An eruption of vesicles disposed in groups, in an acute form, is often found on the genitals of women. It corresponds to the herpes preputialis which, with the same frequency, occurs in the male sex. This eruption appears on the internal surface of the labia majora, on the labia minora, on the vestibule and prepuce of the clitoris, at the orifice of the urethra, occasionally on the external surface of the labia majora, and at times it spreads to the mons veneris. Ravogli has twice seen groups of vesicles on the cervix uteri, corresponding with the observations of Bergh (Über Herpes Menstrualis, *Monatshefte für Praktische Dermatologie*, 1890), who has seen similar eruptions, sometimes accompanied by herpes of the vulva.

Before the outbreak of the vesicles there are in most cases slight burning and itching sensations. Only rarely is the itching very pronounced, and it accompanies the course of the affection.

The eruption consists of a single vesicle, or of a group of vesicles closely arranged, or of vesicles scattered on the surface following the ramification of a nerve. It begins as a red patch, which in a few hours shows vesicles. These are usually small, from the size of a pinhead to that of a hempseed, round, transparent, containing clear serum. When affecting the mucous membrane, on account of the succulence and the thinness of the epithelium they soon break, while on the skin they remain longer. Their contents become turbid and soon form brownish-yellow crusts.

When the herpes is seated on the labia minora it may cause œdema of these parts, on account of the tenderness and laxity of their tissues. The vesicles when broken leave a superficial exulceration corresponding to the size of the vesicle. The bottom is of a rose-red colour, sometimes covered with yellow detritus, with the edges cleanly cut, but not deep, and never as in chancroid. They are usually arranged in a group, and when broken the remaining exulcerations coalesce into one patch with festooned edges, reminding one of the round pre-existing vesicles. The vesicles are seated on an inflammatory base and heal up usually in a few days; in some cases they are persistent; in rare cases they become ulcerated, and it is difficult to distinguish them from a chancroid. Uncleanliness and the presence of gonorrhœal fluid sometimes irritate the resulting exulcerations of the vesicles and make them persistent. Herpes is inclined to relapse at different intervals, but relapses in women are not so frequent as in men.

The *causes* of herpes progenitalis are difficult to determine. Usually this affection is the consequence of an irritation or congestion of the sexual organs. In neurotic women it is found in connection with menstruation, so that nearly every month it is reproduced. In *puellæ publicæ* cases of herpes progenitalis are often met with on account of frequent and forced coitus, and also on account of disproportion of the parts. Herpes often appears in cases of gonorrhœal inflammation of the female genitals, and is often the result of endometritis, salpingitis, and oöphoritis. It may be considered as an abortive zoster, proceeding from irritation and the nervous ramifications of the pudenda, and sometimes it shows this clearly by the disposition of the eruptive patches.

Although herpes progenitalis has been often suspected to be the result of the presence of cocci, yet so far there is nothing positive in this regard. Rohrer (*Monatshefte für Praktische Dermatologie*, 1888) found very few diplococci in the serum of the vesicles, and Pfeiffer (*ibid.*, 1887) in a case of menstrual herpes could not find any microorganisms.

The *diagnosis* of herpes progenitalis is easily made if the vesicles are still present. When, however, the vesicles are broken and an ulceration remains, there may be some difficulty in distinguishing herpes from venereal or syphilitic ulcerations. The superficial character of the lesion, the scanty serous secretion, the peculiar round disposition of the edges, the smoothness of the surface, are characteristics enough to show us that we have to do with a case of herpes. Sometimes, however, a hard chancre in its erosive stage has been mistaken for herpes. (See Syphilis of the Vulva). In women, in whom, especially, the hardness of the lesion is often not clear, we lack one of the most important characteristics for diagnosis. The surface of a chancrous erosion is usually deeper in colour, round in shape, with a smooth surface, and is found in places where the herpes does not usually appear, as in the fourchette and in the ostium vaginæ.

With reference to the possible confusion of herpes with chancroid,

it is difficult for it to occur when we keep in mind the appearance of the chancroid lesion, which is the most reliable diagnostic by itself. Indeed, the punched-out, round, irregular, or ragged, often undermined ulcer, which rapidly spreads, accompanied with abundant secretion, and exhibiting an unhealthy, diphtheroid, worm-eaten surface, can not admit of confusion. At any rate, especially in the beginning, when no other diagnostic characteristics are present, in case of doubt it is better to suspend diagnosis, being sure that, on the following day, the doubt will be dispelled.

Treatment.—As already stated, the use of douches with warm water, having in solution some borate of sodium or any other mild antiseptic, is advised. The general health of the patient must receive its proper care, and the use of mild saline purgatives is advisable when annoyed with constipation, alkaline mineral waters when troubled with catarrhal conditions of the digestive organs, iron tonics and reconstructives when symptoms of anæmia and general denutrition are present. Locally, the application of a wash containing lead and opium is very useful, especially when the herpetic eruption is accompanied with pain and irritation. Touching the ulcerated surface with a solution of nitrate of silver, from 6 to 8 per cent, has given very satisfactory results. The surface is then covered with an innocent salve, as Wilson's ointment, or with vaseline containing some carbolic or salicylic acid. The application of powders is also used with some benefit. Iodoform is objectionable because of its odour; but aristol and europhen are applied with advantage on the exulcerated surface. The powders have the disadvantage that they form crusts with the secretion, which soil the exulcerated surface. Ravogli prefers the use of powders when the surface is healing, at which time the parts may be dusted with oxide of zinc, subnitrate of bismuth, rice powder, or any other substance capable of keeping the surfaces dry and separated.

The application of camphorated alcohol has been used as an abortive measure, and in the same way Depás, of Lille, advocates the application of compresses of absolute alcohol, to which 2 per cent of resorcin and 1 per cent each of menthol and carbolic acid are added.

Pruritus Vulvæ.—In this affection there is no apparent eruption on the genitals; it is characterized only by an intense itching sensation of the vulva and of the vagina without apparent external causes. In cases of the presence of eczema, of lichen, prurigo, or of insects, the itching is due alike to the alteration of the skin and to the irritation of the insects; but in cases of pruritus vulvæ the itching is the only symptom—one so persistent and so intense that it compels the woman to scratch and to rub the genitals, producing excoriations. If this condition lasts some time, then eczema, inflammation, swelling, and œdema of the skin of the genitals are often found, caused by the scratching and tearing of the skin. The continuous itching and the desire to scratch and rub the genitals makes the woman inclined to masturbation or to coitus, rendering her hysterical and nymphomani-

acal. The irritation from scratching and the inflammatory process of the external genitals spread to the mucous membrane of the vagina and cause a catarrhal discharge from this organ, which increases the itching sensation.

Pruritus vulvæ is more often met with at the time of the menopause in women who are of nervous disposition or suffering from the recognised neuroses. At other times it is a premonitory symptom of a great many lesions of these organs, as fibroma, and sometimes of carcinoma.

The *pathology* of pruritus vulvæ has been carefully studied by J. C. Webster. (*Transactions of the Edinburgh Obstetrical Society,* 1890–'91.)

As regards the *naked-eye appearances,* there may be more or less hypertrophy, or none at all. As regards the hypertrophy in such cases, it is impossible to say whether it is to be associated with the primary pruritus or to be regarded as resulting from continued rubbing and scratching. It is not a constant factor. There are also many cases of simple hypertrophy without any accompanying itchiness. The microscopical changes found in the tissues removed in Webster's cases were of great interest, and were probably the cause of the disease. These changes were of the nature of a slowly progressing fibrosis, affecting chiefly the nerves and nerve endings of the clitoris and labia minora. Many of the nerves, if traced from deeper parts toward their terminations, were seen to acquire a dense fibrous character, some appearing as well-marked fibrous cords, the nerve fibres being compressed or destroyed. In some cases they could be followed to their special end corpuscles, which also showed the same changes. The changes were most marked in the clitoris.

The Pacinian corpuscles did not appear to be affected, save in one instance where there were an abnormal number of cells in the central core. Some globular end bulbs showed an increased number of cells; others appeared as dense fibrous knobs. Some of the genital corpuscles showed the change in a marked degree, the windings of the terminal nerve fibres being often almost obliterated. The changes found in the connective-tissue framework of the clitoris and nymphæ were different, being of a subacute inflammatory nature, and evidently more recent in origin than those found in the nervous structures. They were found most marked in the corium under the papillæ, and affected especially the prepuce and nymphæ, being found in the clitoris only in the glans under the epithelium, and much less marked than in the labia minora. In the corium of the latter were seen many minute vessels with abundant exudation of leucocytes into the perivascular lymphatics, while in many parts the subepithelial tissue was a mass of leucocytes and proliferating connective-tissue corpuscles. These changes were most marked in the hypertrophic nymphæ. They were distinct from the chronic fibrosis affecting the nervous structures, and were, no doubt, due to the long-continued irritation of the scratching. They affected chiefly the superficial parts—viz., the prepuce and nymphæ—the nerve fibrosis being most marked in the clitoris, in which there were only a very few

acute or subacute changes under the epithelium covering the surface of the glans.

The *causation* of pruritus vulvæ has always been shrouded in more or less mystery. While it is true that it is only a symptom, its presence does not imply the existence as a cause of any of the recognised pruriginous diseases of the skin of the vulva. It is true that in these affections itching is a conspicuous and aggravating symptom, but it is one the existence of which is explained by manifest pathologic changes. In pruritus vulvæ there are no such obvious changes; or, if there are, they are as liable to be consequences as causes. Bronson considers a general neurotic condition, either congenital or acquired, as a predisposing cause, and recognises a state of impaired conduction in the nerve of tactile sense as another causative factor. Though this usually occurs as a concomitant of hyperæsthesia of the skin, it is possible that it may exist independently of the latter, particularly in the atrophic changes of old age, while among the exciting causes he speaks of irritations transmitted from nerve centres, direct or local irritations, from irritants applied to the skin, or from intracutaneous sources, such as the lesions of trophic cutaneous diseases and their products; toxic or noxious materials deposited from the blood; effects of local nutritive disturbance or deranged metabolism in the cutaneous sensory nerves; and, finally, spastic contraction of the arrectores pilorum muscles. While this summarization of the etiology of the disease deals largely with more or less speculative pathology, it is still suggestive of what closer observation may prove to be the real causation of the disease. Ravogli, in common with other observers, recognises diabetes, or rather diabetic urine, as an exciting cause. Feinberg (*Centralblatt für Gynäkologie*) described two cases of idiopathic pruritus vulvæ, occurring during the course of pregnancy, in which the aggravating symptoms subsided after parturition.

Treatment consists in cold applications, alcoholic or ethereal, in the form of compresses applied on the genitals. Cold is more apt to relieve the itching than warm applications. In these solutions some carbolic or salicylic acid may be dissolved in the ratio of 2 per cent, and in these cases affords some benefit. Sitz baths with warm water, to which some bran has been added or some sodium bicarbonate, are to be recommended. In the same way the application of vaginal douches with mild solution of borate of sodium, alum, etc., are beneficial; these douches should be followed by the application of tampons dipped in some ointment containing opium; but the application which in Ravogli's hands has been most frequently successful is a tampon dipped in ichthyol (25 to 50 per cent) and glycerine. In very severe cases resort to suppositories of cacao butter with one fifth of a grain of morphine or cocaine has been recommended.

Kholmogoroff reports success from the use of galvanism with the positive electrode, insulated to its distal tip, introduced 4 or 5 centimetres within the vagina, while the negative, covered with chamois

and moistened with a salt solution, was applied over the affected area. It should be remembered in this connection that chamois repeatedly applied to the skin may become infected and itself become the carrier of infection. Heidenhain applies compresses wet with a hot solution of a tablespoonful of tannin in a quart of water, the vagina having been previously douched with an antiseptic solution. This treatment is repeated every night. Nitrate of silver, sulphate of zinc in solution, and thymol in a 10-per-cent ointment, are recommended as valuable remedies. It is probable that for the relief of the purely functional pruritus careful attention to a hygienic *régime* comprises the best remedy. This should consist in frequent local ablution not attended with undue friction, in following a wholesome and laxative diet, and in relieving the generally accompanying constipation.

Surgical Treatment.—When, however, pruritus vulvæ ceases to be a purely functional disturbance and depends for its continuance upon the development of fibrosis in the terminal nerve filaments, as described by Webster, the change must be looked upon as permanent and topical, and constitutional remedies must be recognised as quite inefficient. Relief under these circumstances can be given the agonized patient only by freely excising the affected area. In determining the extent of this operation it is essential first to ascertain the limits of the pruriginous areas. These, when ascertained and delimited, should be freely excised. The operation will generally involve the removal of the clitoris and its prepuce, the labia minora, and frequently the integument from the inner aspect of the labia majora. In the performance of this operation the procedure designated in the chapter on clitoridectomy may be followed, the only change consisting in the extension of the area of denudation.

Parasitic Affections of the Skin of the Female Genitals.—The skin of this region is sometimes affected with the vegetable parasite *Trichophyton tonsurans* in the form of *eczema marginatum*. On account of the condition of the skin, which is often macerated by the perspiration, the affection has so peculiar an appearance that for a long time it has been discussed whether it was the result of the same parasite, and for this reason Hebra called it eczema marginatum. At present it is accepted that this affection is nothing else than an ordinary ringworm, modified in its appearance by the locality. The moist condition of the epidermis allows the parasite to grow with more vigour, and the increased inflammation gives the different appearance to the affection. It is an affection found, not only on the genitals, but wherever two surfaces of the skin are close to each other. In this way we find eczema marginatum of the axilla, of the breast, and of the cruro-genital fold.

It is usually seen when fully developed. It appears as a reddish, moist, pigmented area circumscribed by a red, somewhat raised border, forming a circle or an arc of a circle. The border is formed by small papules or vesicles covered with brownish-yellow crusts. The surface is often excoriated as a consequence of scratching on account of the

itching sensation accompanying this affection. The rings do not remain limited to the genital sphere; sometimes when the disease is left without treatment they grow to reach the anal region, and spread on the pubis.

It is rather difficult to demonstrate the presence of the *Trichophyton tonsurans* in the scales or in the crust, but with some patience and repeated experiments the fungus is found, in appearance like that of the ordinary ringworm.

It is easily cured; sulphur is the best remedy. Ravogli directs the patient to wash the parts with green soap, and after washing and drying, the affected skin is covered with a thick layer of Wilkinson's ointment, of which we have already given the formula (page 194). Bulkley recommends the use of sulphurous acid, applied in the form of compresses on the surface. Many other remedies are used in trichophyton, such as chrysarobin or beta-naphthol, in the form of salves, which can also be applied with good results.

The affection is easily manageable, and after six or eight applications of Wilkinson's ointment, continued until the epidermis exfoliates, we are sure of the success of our treatment.

Pediculi Pubis.—A kind of pediculus called *Phtheirius inguinalis* may be found infesting the hairy parts of the woman's pubic region. Although the hairs of the pubes are the ordinary habitat of this insect, yet it may also find its way to the hair of the axillæ, and in the man to the beard. This insect has a peculiar shape, resembling the form of a crab, and for this reason it has been called crab louse, and vulgarly crabs. It hangs to the shaft of the hair, inserting its proboscis into the follicle so as to obtain its nourishment from the sebaceous glands. To the naked eye it looks like a yellowish scale or a little crust. It causes a great deal of itching sensation, but this is seldom so severe as to cause deep excoriation, as in the case of the body louse. It always comes by contagion; sexual intercourse is the most common way of transmission of this insect, but it can be taken also from clothing, bedding, and from contact with the seat board of a public water-closet.

This insect is very inactive; it hangs fast to the hair and to the skin, so that it is difficult to detach it. With its powerful claws it holds firmly to the hair, so that in attempting to remove it, it slides for some distance before loosening its hold. The eggs of this louse are small and adhere to the hair.

A close inspection of the part affected will reveal the presence of the insect and of the nits.

Treatment.—The old application of mercurial ointment is still to be recommended; one or two applications are sufficient to destroy the insect and the nits. This application, however, is somewhat dirty and may produce irritation and dermatitis. The ointment of white precipitate is also recommended. In his clinic Ravogli finds that coal oil gives good results; two applications are enough to kill the insects and nits. Oleate of mercury has also a good effect. After any one of these

applications the patient takes a bath and changes the clothes in order to prevent a new transmission.

Atrophy of the External Female Genitals (Kraurosis Vulvæ).—Under the name of *kraurosis vulvæ* there has been recently described an atrophy of the vulva. The name was given to the affection by Breisky, using the Greek name κραῦρος, parched, hence withered. The atrophy is strictly limited to the skin and to the subcutaneous tissue, involving the labia majora, the fourchette, and sometimes the perineum. Charles A. L. Reed (*New York Medical Journal*, September 29, 1894) stated that he had never been able to observe either clinically or microscopically the extension of this disease to the mucous membrane of the ostium vaginæ, and he believes that this affection is essentially restricted to the vulvar integument. For this reason the disease has also been given the more appropriate name of progressive cutaneous atrophy of the vulva.

The first description of this disease is due to Robert F. Weir, of New York, who in 1875 described this affection as an ichthyosis vulvæ. (Ichthyosis of the Tongue and Vulva, *New York Medical Journal*, March, 1875.) Although he believed that he was describing a case of ichthyosis, yet the symptoms have such an analogy with those of this affection that there is no doubt that he described a case of kraurosis. The knowledge of this disease is really due to Breisky, of Prague (*Archiv für Heilkunde*, Prague, 1885). In 1885 he reported twelve cases with a careful study of the symptomatology and of the pathologic alterations. Possibly such cases had come to the attention of the gynecologist before that time, but the condition had not been pointed out as a pathologic entity. Since the publication of Breisky the subject has been brought to the attention of the Obstetrical and Gynecological Society of Berlin, where, after a full consideration, the disease in question was recognised as a morbid entity.

The first *changes perceptible to the naked eye* are small reddish areas around the ostium vaginæ; they are not elevated; on the contrary, they are somewhat depressed. They are painful to the touch, and sexual intercourse is painful and futile. The vaginal orifice is very narrow, and there is a diminished elasticity of the tissues. The skin and the mucous membrane have at this point lost a great deal of their pigment and have become thin and translucent, tense and glossy, so as to have lost all the normal folds of the vulva. The ostium vaginæ is very narrow. The shrinkage is one of the leading features of this disease, but it is manifested, not over the whole region, but in different areas. From these centres the process gradually extends until the vulva has been entirely involved. The labia minora are fused together with the labia majora, and scarcely a trace of them is to be seen (Fig. 72). In some cases the mons veneris is also found in an atrophic condition, associated with complete alopecia.

According to the observations of Breisky, in none of his cases had there existed symptoms of inflammation or of exanthematous affection

in the external genitals. In some of his patients an unbearable itching sensation was present. Some of the women were pregnant and the itching sensation spontaneously disappeared at the end of the gestation. In one of the gynecological cases the woman suffered with an itching sensation, which lasted only a few weeks. In two private cases he found one patient who had been afflicted with pruritus for several years, the affection being most annoying at night; she also had leucorrhœa and menorrhagia. In another case the pruritus had been present for nearly three years, with relapses at the time of the menstruation lasting from two to three days.

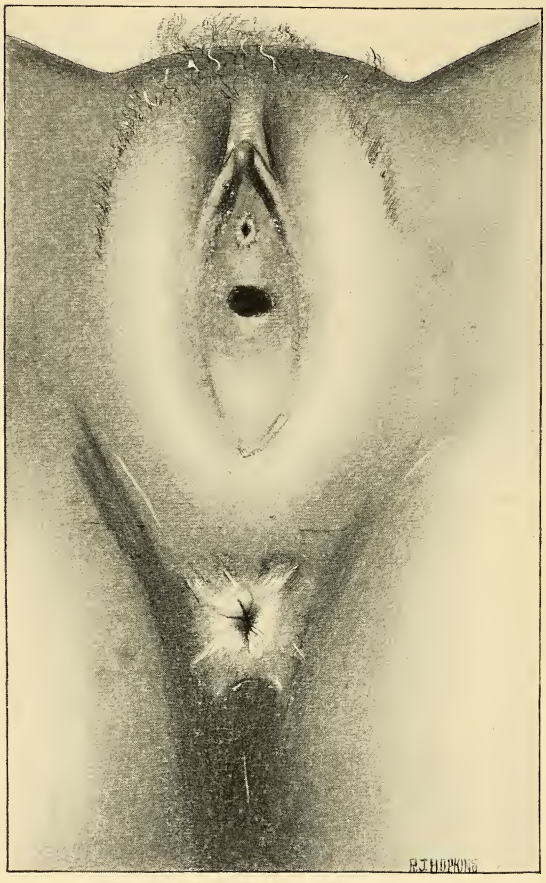

Fig. 72 (Reed).—"The labia minora are fused together with the labia majora and scarcely a trace of them is to be seen."—Ravogli (page 207).

Breisky drew his conclusions from the consideration of all his cases as follows: That chronic vaginal catarrh was present in 4 cases; that in 2 cases scars were present from progressed scrofulous abscesses of the cervical glands; not one had suffered with syphilis; 1 was sterile, 2 were multiparæ, 5 had given birth to one or more children. Not one of the multiparæ had had trouble with her delivery, and in no one had there been an inflammatory process of the external genitals. Although Breisky was of the opinion that this disease was the result of a chronic eczema, yet he never could find this affection in his cases. In the same way the pruritus seems to be one of the principal causes of this disease, and yet only in 3 of his cases was it present.

Indeed, the *etiology* of this disease is very obscure. It occurs without previous existence of other diseases of the skin of the vulva. In

the cases reported by Orthmann no sugar could be found in the urine and there was no history of syphilis. In the cases reported by Reed, in one there was a history of progressed syphilis in early life, but no later manifestations could be found. So that it has been established and confirmed by Lewin (*Centralblatt für Gynäkologie*, 1894) that the atrophy of the vulva is not of a syphilitic origin. Gonorrhœa and no specific chronic catarrh are considered by some observers as probable etiological factors. This disease is found only in women over forty, which would identify this atrophy with trophic changes induced by advancing age. Olshausen lays a great deal of stress on the extirpation of the uterine appendages as a cause of this atrophy, which relation was found in one of Reed's cases. In one of Jevonsky's cases the affection had started from a cicatrix in a lacerated perineum. From the multiplicity of the possible causes held to be factors in this disease, it seems that no one must be considered as such, and Reed prefers the theory that the peripheral trophic nerves or their ganglia are to be considered as the origin of this disease.

This *histologic condition* of the skin, as found by H. W. Bettman in Reed's cases, shows, as one of the most important features, a marked hyperæmia, which in some places assumes the character of true hemorrhage. The epidermis shows great changes according to the different places; in some points it is hardened, thickened, and hypertrophic, in other places thin and atrophic, and in other places has nearly disappeared (Fig. 73). The corium shows two different conditions. One is due to the exudation and infiltration of round inflammatory cells into the stroma of the corium, and the other is due to the sclerosis and atrophy of the tissues. These are two different conditions, one the consequence of the other, and due to the changes of the process. In the first condition the papillæ are infiltrated, in the second

Fig. 73 (Reed).—"The epidermis shows great changes according to the different places."—Ravogli.

they are shrunken and have nearly disappeared. In the same case the different sections show a difference in the pathologic alterations. From the above observations it is plain that the anatomic lesions are of a different character, according to the stage of the disease. In the beginning the hyperæmia and exudation predominate in the tissues, later the lesions consist of a thickening and shrinking of the tissues in sclerosis.

The *subjective symptoms* of this disease consist at first of painful points and a painful inelasticity, which are impediments to the copulative act. In the later period there is a loss of sensation in the entire diseased area. Itching is not a constant symptom, and in most of the cases is absent. In 35 cases referred to by Ohmann-Dumesnil 13 cases were troubled with itching in various degrees. In 5 cases referred to by Orthmann (*Zeitschrift für Geburtshülfe und Gynäkologie*, Stuttgart, 1890) only 1 patient complained of an itching sensation. In 6 cases referred to by Reed, 2 only were annoyed in that way, and that only at the beginning of the affection.

The *diagnosis* is often made as vaginismus in the beginning of the affection, but careful inspection will reveal the sensitive areas at the ostium vaginæ and the already begun shrinkage of the vulvar integument. When the areas of atrophy have begun it is possible to mistake the disease for ichthyosis, but in this disease there are adherent scales, which are never found in kraurosis.

In reference to the *prognosis*, Tait says that the patient should always be informed that the progress of the disease will extend over years, that it will certainly get well in time, but that treatment from time to time will give relief. It seems that the recovery alluded to is nothing else than the disappearance of the subjective symptoms. We can not promise recovery to the patient affected with this disease under any circumstances.

The *treatment* may be divided into palliative and curative. The first is obtained by remedies to relieve pain. Carbolic acid in the form of a lotion, on account of its anæsthetic quality, affords some temporary relief. Tait recommends the application between the small labia, at bedtime, of a piece of cotton dipped in a solution of neutral acetate of lead in glycerine, as capable of giving relief. A mixture of tannin and salicylic acid in glycerine has been used in the same way with good results. Tait condemns cocaine as useless and irritating. The application of nitrate of silver in stick to cauterize the degenerated patches, so as to obtain a good cicatricial tissue, diminishes the sufferings, but does not arrest the progress of the disease. Heitzmann tried to scrape off with a sharp curette the hard tissues involved, but the length of time this process takes, and the poor results it gives do not commend it. The general tonic treatment must be strongly enforced so as to improve the general condition of the patient.

As a curative treatment Reed mentions an operative process by excision. This he applied in an incipient case of kraurosis, which was limited to a vascular ring around the ostium vaginæ. The mucous

membrane of this locality was completely excised in the form of an ellipse, and the denuded edges were brought together by means of interrupted sutures. The patient had some temporary relief, but seven months after, the disease appeared on the integument. Martin, as reported by Orthmann, has begun the method of a complete excision, which must be applied according to the affected parts, removing the tissue thoroughly and approximating the edges. In this way eight cases operated upon by Martin completely recovered. The same operation in the hands of Reed has given very good results (Fig. 74). It is necessary not to operate in the beginning of the affection, because the process is not yet limited, and it is liable to spread, in spite of the operation. But when the operation is performed at the time that the sclerotic process is limited, then there is no danger of a recurrence of the disease.

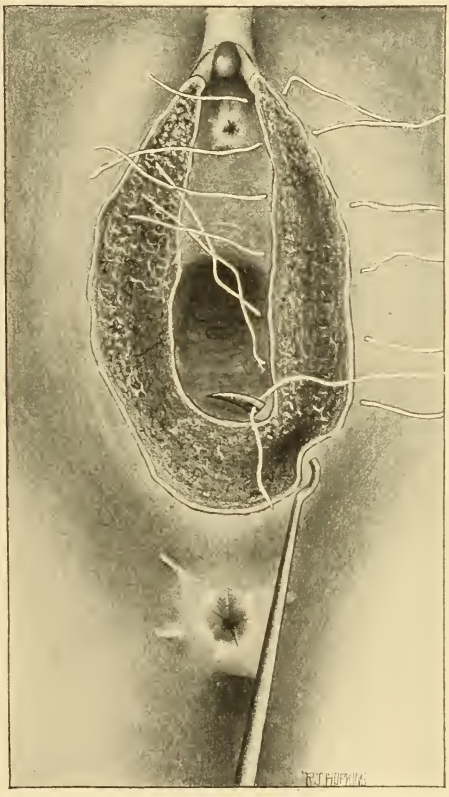

Fig. 74.—"The same operation in the hands of Reed has given very good results."—Ravogli.

Vulvar Adhesions.—The vulva externally consists of integument arranged in a series of folds with proximal surfaces. The fold between the labia majora and the labia minora and that between the glans of the clitoris and its prepuce, are striking examples, while the surfaces of the labia majora lie in approximation, particularly in case of pudendal redundancy. These proximal surfaces are ordinarily prevented from becoming adherent through the protective influence of the epithelial layer of the skin. There occur cases, however, of antenatal blending of these structures (see Malformations of the Vulva); others in which adhesion occurs speedily after birth; and still others in which, as the result of desquamative or similarly destructive inflammation of the skin, the epithelium becomes destroyed and the now denuded and approximated surfaces unite. Morris (*Transactions of the American Association of Obstetricians and Gynecologists,* 1892) called attention to the frequent *adhesion of the prepuce to the glans clitoridis,* a condition

which, he insists, exists, to a greater or less extent, in 80 per cent of Aryan American women. He finds it very rare among the negresses; and looks upon its occurrence as a phase of evolutional change. When preputial adhesions are extensive, the glans clitoridis and the imprisoned mucous follicles remain comparatively undeveloped, but attain their normal growth after liberation of the adhesions. When these adhesions are slight they are of practically no clinical importance, but when they embrace a considerable part, or the whole, of the glans clitoridis, they cause profound disturbances; so much so, that Morris considers that preputial adhesions probably form the most common single factor in invalidism in young women. Bacon (*American Gynecological and Obstetrical Journal*) summarizes his observations and experience of preputial adhesions in the female, with the statement that they are prone, by the irritation they induce, to cause masturbation and the various neuroses; and that the prevention by them of the development of the glans clitoridis frequently results in eroticism. The damaging influence of these adhesions is experienced relatively more in the child than in the adult, for the reason that in the former the reflex nervous centres are less under the control of inhibitory impulses, and peripheral irritation consequently produces disturbances that would not be experienced in maturer years. The *treatment* of this condition consists in breaking up the adhesions as soon as they are found, or particularly as soon as they are recognised as causes of mischief. Bacon is of the opinion that every female child should be examined, and the clitoris, if found adherent, should be liberated in the earlier weeks of life. The operation for this purpose consists in peeling the prepuce off the glans by means of a grooved director or other blunt instrument, and in keeping the area dressed antiseptically until it heals, care being taken frequently to separate the proximal surfaces to prevent readhesion. In labial adhesions, particularly when these are of antenatal occurrence, the structures are frequently so intimately fused as to defy separation. In certain of these cases the labia minora will be found implanted upon the surfaces of the labia majora so intimately that upon retracting the latter the former can be detected only in outline. This condition is rarely of any clinical importance. It may, however, give rise to local disturbance from the accumulation of sebaceous matter secreted by the rudimentary follicles that are incarcerated within the adhesions. When this occurs the accumulation should be liberated by incision, while at the same time an effort should be made to break up the fusion.

CHAPTER XVIII

HYPERTROPHIC AND HYPERPLASTIC DISEASES OF THE PUDENDAL ORGANS

Hypertrophy of the clitoris—Condylomata—Elephantiasis—Polypi—Treatment.

The hypertrophic and hyperplastic diseases of the pudendal organs are, as a rule, acquired. Congenital hypertrophy of the vulva is comparatively rare and is confined to single parts of the pudendum. The parts usually found enlarged in congenital hypertrophy are the labia minora and the clitoris. In the case of the former, it is often difficult to decide at the time when the observation is made whether one is dealing with a true congenital condition or with one acquired by accidental pathologic processes. Manipulations are employed by certain tribes to bring about a hypertrophy of the labia minora. As is well known, the South African Hottentots, by certain methods practised on their female children, produce that enormous hypertrophy of the labia minora described as the "*Hottentot apron.*"

Hypertrophy of the clitoris, while occasionally an acquired condition, is probably the most common form of congenital hypertrophy of the pudendum. A large number of cases of this kind have been described, one of the most remarkable by Fehling, who reported the case of a girl of twenty-one years with a clitoris five inches long, as thick as a thumb, and with a glans one inch long. Extensive congenital hypertrophy of the clitoris is frequently combined with atresia of the labia minora, descent of the ovaries, and other anomalies obscuring the true sex of the individual, and bringing about the condition known as *female pseudo-hermaphrodism.* (See Malformations of the Vulva.) This condition is simply one in which, owing to anomalous development, the pudenda simulate to a certain degree the male organs of generation.

Of the acquired hypertrophies and hyperplasias, there are two important groups of morbid conditions which have to be considered, viz., the *condylomata* and *elephantiasis.* Both of these are more properly to be looked upon, not as truly neoplastic formations, but as hypertrophic and hyperplastic diseases, since they develop upon an inflammatory basis.

Condylomata are usually present as elevated condylomata (*C. acuminata*), more rarely as broad condylomata (*C. lata*). They develop on an inflammatory basis, which may be simple, gonorrhœic, or syphilitic. Condylomata, are, however, not to be considered as a specific

process, but as a secondary hypertrophy, developing, as the case may be, on either a specific or a nonspecific soil. In an early stage these hypertrophies form small, pointed elevations, warty in character. They are found on the labia majora and labia minora, the clitoris, the mons veneris, and they spread not infrequently over the skin of the perineum, around the anus, and over the inner surfaces of the thighs. They are first found united in smaller groups, with spaces between them free from excrescences. Later on, they often become confluent, forming large masses which hide entirely from view the whole of the pudendum, the latter being then covered by an uneven, irregular, ragged, papillomatous, or cauliflower mass (Fig. 75). In colour they

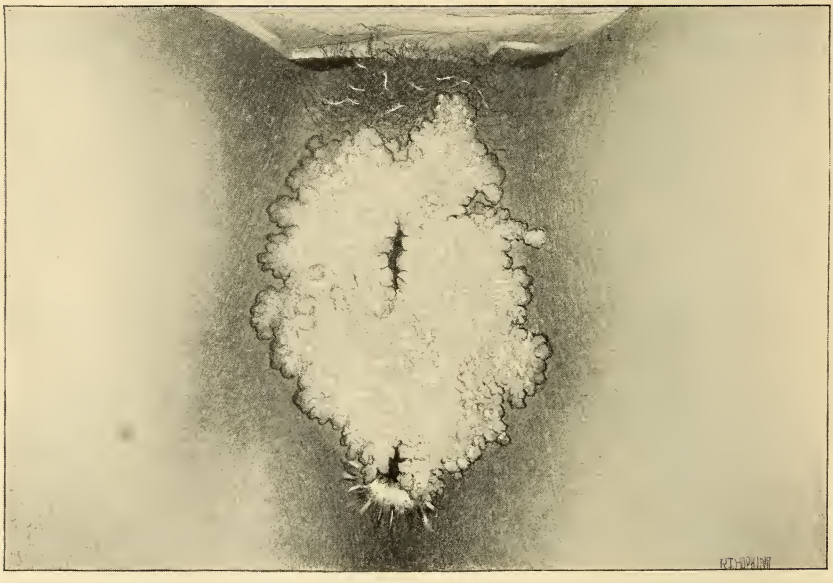

Fig. 75.—"They become confluent, forming large masses which hide from view the whole of the pudendum."—Herzog.

may vary from a grayish-white to a pink or rose-red. The surface may be dry and shiny, or it may be moist. It is usually not ulcerated, unless it has been subjected, in consequence of very improper care, to a good deal of friction or other irritation. One of the notable features of these condylomatous masses is their very rapid growth during the period of gestation. This is evidently due to the increase of the blood supply to the genital organs in pregnancy.

Microscopic examination of condylomatous masses shows that they consist mainly of enormous hypertrophies of the papillary layer of the skin. The papillæ, normally short and simple, become elongated and branched like a tree; they divide dichotomously or in a digitate manner. These hypertrophied papillæ consist of connective-tissue fibres and round, oval, or stellate cells, supporting a network of blood vessels. The

finest papillary branches are mainly composed of blood vessels with only scanty connective-tissue fibres and cells as a stroma. The hypertrophic fibrillar connective tissue frequently shows an extensive round-cell infiltration consisting of polynuclear leucocytes and mononuclear lymphocytes. The epithelial layer covering these complicated hypertrophic papillæ is thickened. The thickening is noticeable in the Malpighian layer, or stratum germinativum, as well as in the older more superficial strata.

Condylomatous, cauliflower masses of the vulva, may be confounded with carcinomata of the vulva, which are also apt to form cauliflower excrescences. Besides the clinical features which have to be considered, a careful microscopic examination of a series of sections, made vertically in the direction of the papillary layer, can always clear up the diagnosis. We have in carcinoma as the most prominent histological feature the great proliferation of the epithelia of the skin. These proliferating cells form alveolar or tubular nests which are surrounded by connective tissue. In condylomata, on the other hand, we have the great hypertrophy of the connective tissue, and the hypertrophic connective-tissue masses are surrounded by layers of epithelial cells.

There occur also certain small excrescences on the pudendum, due to frequent masturbatory manipulations, which must not be mistaken for what is to be classified as a true condyloma of the vulva. The excrescences of this type, which may to some extent simulate an early stage of condylomata acuminata, are generally found on the mucous membrane between the margin of the hymen and the labia minora, and also in the neighbourhood of the external meatus of the urethra. They are easily distinguished from true condylomata by the fact that they are small in size, simple, and not branched. They occur on the mucous surfaces only, and do not spread to the epidermal surfaces of the vulva or neighbouring parts. They are never infectious in nature, and occur most frequently in virgins of a hysterical disposition. Keeping these points in view, one is not likely to mistake these masturbatory excrescences for true condylomata.

The *treatment* of the venereal warts consists in their removal. This is done either by surgical means or by caustics; the first, however, is always preferable to the second.

In case of small warts on the female genitals, they must first be washed with a solution of bichloride (1 to 1,000), or with a solution of carbolic acid (1 to 100). After drying them with cotton they are soaked with a cocaine solution (5 per cent), and then they are scraped off with a sharp curette, removing the small growths completely. On account of the richness in blood vessels of the warts at their points of insertion they bleed freely. The bleeding is stopped by the application of a tampon dipped in a saturated solution of perchloride of iron. With this process Ravogli has obtained very good results, and he states that very seldom has he seen a recurrence. In case the warts should grow up again, it is better to destroy them at once by touching them with a

solution of chloracetic acid, lactic acid, or acid nitrate of mercury. Taylor recommends the use of collodion containing bichloride of mercury, 30 grains to the ounce, or salicylic acid, 1 drachm to the ounce.

Caustics are used independently of the curetting to obtain the destruction of the venereal warts. A strong solution of chromic acid, from 1 to 4 drachms to the ounce of water, has been applied, but the pain which results is absolutely unbearable, and the cauterization is not limited, affecting also the healthy skin. J. W. White referred to the case of a woman who died in collapse in twenty-seven hours from the application of this solution on warts affecting the vulva and the anus. (*Journal of Cutaneous and Genito-urinary Diseases*, 1889.)

When the condylomata have attained an extraordinary development, it is necessary to remove them with the galvano-cautery loop, by which means we can prevent loss of blood.

When there are warts round the meatus of the urethra, care must be taken not to cause any laceration or wound, which may be the origin of a scar stricturing the meatus.

Taylor recommends the application of a powder of equal parts of calomel and salicylic acid, which has often given him very satisfactory results.

Cæsar Boeck (*Monatshefte für praktische Dermatologie*, 1886) recommends the application of a watery solution of resorcin on the condylomata, especially when they have a tendency to recurrence. He uses also a powder of resorcin, eight parts, and bismuth subnitrate and boric acid, one part each, to dust the condylomata, claiming prompt and effective results.

The following formula, which is applied after the warts have been well bathed with a solution of bichloride, as above described, has been also praised:

℞ Acidi salicylici, } ..... āā ʒss.;
Chrysarobini, }
Collodii flexilis ..... ℥j.
M. To be applied twice a day.

In Ravogli's clinic he has found formaldehyde very useful, which he applies in a strength of from 8 per cent to 42 per cent, as it comes in commerce. The application of pure formaldehyde is rather painful and requires the previous use of cocaine to diminish the pain. One or two applications have been sufficient to cause the condyloma to become necrotic and slough off. It is necessary to direct attention to the condition of the vagina and of the womb, to be sure that gonorrhœa has entirely ceased.

Elephantiasis vulvæ may be defined as a pale whitish tumour formation, or swelling, arising from the labia majora and labia minora and from the clitoris. It is by no means an easy matter to properly classify elephantiasis vulvæ. There is practically nothing known as to the true

etiology of this affection, but it appears that most cases of elephantiasis develop on an inflammatory soil. It is certain that all fully developed and characteristic cases histologically represent an immense hypertrophy of connective-tissue elements. Hence elephantiasis vulvæ is here classified under hypertrophic diseases of the pudendal organs. It must, however, not be forgotten that elephantiasic formations in other parts of the skin have been shown to be true neoplasms, lymphangeiomata—i. e., tumours consisting of newly formed lymph vessels and other lymphatic elements.

Elephantiasis vulvæ may develop from a single place, or it may be multiple from the start, the single component parts becoming confluent later on in the course of the disease. The connective-tissue proliferation in elephantiasis leads to the largest tumour formations that are found in connection with the pudendal organs. In its incipient stages, elephantiasis can not be distinguished clinically and macroscopically from any simple noninflammatory hypertrophy, but, later on, the enormous size of the hypertrophic formation distinguishes it clearly from any other known condition. In growing, the tumour gets so heavy and large that it becomes pedunculated in consequence of its own weight, the main mass often reaching down to the knees. While, with us, elephantiasis vulvæ is a comparatively rare disease, it is quite frequently met with in some of the Eastern and tropical countries. The different forms of this affection have been variously classified according to certain prominent morphological characters. Tumours showing even surfaces have been called *elephantiasis fibrosa*, while those showing a warty surface have been called *papillary elephantiasis* (Fig. 76). Another classification makes three subdivisions, as follows: Smooth surfaced tumours covered by skin which is not materially different from the surrounding epidermis—*elephantiasis glabra*; tumours showing an irregularly nodular surface—*elephantiasis tuberosa*; and tumours with a surface showing numerous small warts and excrescences—*elephantiasis condylomatosa*.

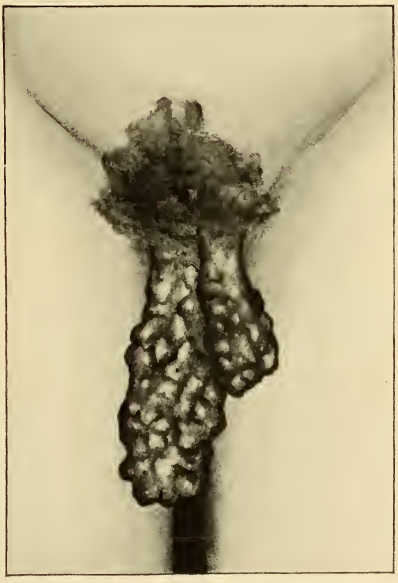

Fig. 76.—"Tumours showing a warty surface have been called *papillary elephantiasis*." —Herzog.

The microscopic picture of elephantiasis vulvæ varies according to the variety of the tumour and its stage of development. In the smooth

and tuberous forms the great mass of the tumour consists of a tissue composed of old fibres quite poor in nuclei. This connective tissue shows a marked œdematous infiltration and is sparingly vascularized. Capillaries and small arteries exhibit a perivascular round-cell infiltration. The papillary body of the derma is poorly developed, the epithelial layers are thinned out, sebaceous and sweat glands are present in small numbers only, and even absent over large territories. While in the first two forms described, the papillary body is not hypertrophic, but rather atrophic, the third form, the elephantiasis condylomatosa, is characterized, like the true condylomata, by a well-marked hypertrophy of the papillæ of the skin. In all three forms, when well advanced, there is also a great deal of thickening of the subcutaneous connective tissue, in which sometimes evidences of new formation of lymph vessels may be found. Pozzi and other French authors describe the history of elephantiasis as presenting a number of stages. The hypertrophied skin, according to their description, first takes on an embryonal type, containing also large lymph spaces like those found in true lymphangeiomata. There occurs then, after an œdema has been established, an extensive lymph stasis and infiltration of the tissues with lymph. In this stage, there are also found in the elephantiasic tissues lymph glands in a state of fibrous degeneration. The last stage is represented by an enormous thickening of the skin, which, according to the French authors, from whom others differ, comprises all the layers. According to the view now generally adopted, the thickening in most cases is chiefly confined to the subpapillary and subcutaneous layers.

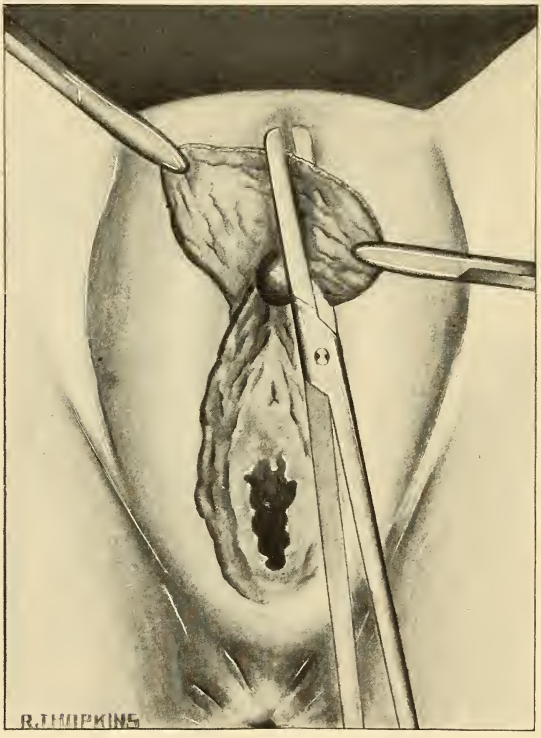

Fig. 77.—"The prepuce, now divided into two flaps, is cut away."—Reed (page 220).

Superficial ulcerations not infrequently occur when the tumour

has attained a larger size, and sometimes the lymph vessels are so greatly enlarged and dilated that they produce a *lymphorrhœa* from the ulcerating portions.

The etiology of elephantiasis is still very obscure. Patients suffering from elephantiasis vulvæ not infrequently present the cicatrices of inguinal buboes or scars on the vulva. Frequently a history of syphilis may be obtained, and undoubted syphilitic manifestations may coexist with elephantiasis. The latter, however, can not be eradicated by an antisyphilitic treatment, though one sees occasionally a transitory improvement after the free exhibition of the iodides.

Polypi of the vulva, which authors frequently classify under neoplasms of the pudendal organs, belong more properly, if one excludes the true fibromata, to the hypertrophic and hyperplastic diseases. These polyps, usually found in the neighbourhood of the external meatus, represent hypertrophies of the mucous membrane of the vestibule. They vary from the size of a pea to that of a hazelnut, are soft and pinkish in colour, smooth or mulberry-like, sessile or pedunculated. Microscopically, they show a loose fibrillar connective tissue with round-cell infiltration, are covered by squamous epithelial cells, and often contain glandular spaces lined with columnar epithelium. They are due to inflammatory irritations, and it has recently been found that they sometimes contain gonococci.

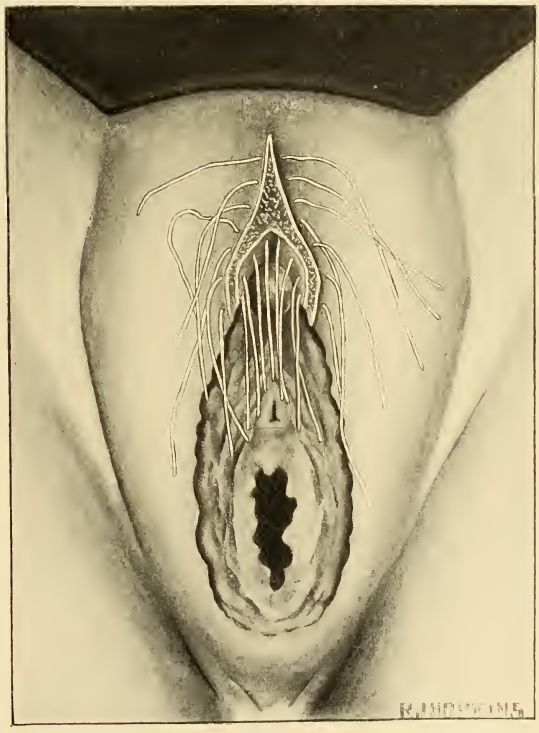

Fig. 78.—"The exposed raw surfaces are closed by a series of fine catgut sutures."—Reed (page 220).

The **treatment** of hypertrophic and hyperplastic diseases of the pudendal organs is almost exclusively surgical. Polypi should be treated in the same manner. Acquired enlargement of the clitoris, when a source of persistent local or constitutional disturbance, should be treated by extirpation. (See Clitoridectomy.) E. C. Dudley looks

upon acquired hypertrophy of the clitoris, and more particularly its prepuce, as being ordinarily the result of masturbation. Those cases in which the clitoris is moderately enlarged and surrounded by an abundance of loose, flabby, redundant preputial skin, he treats by what he calls circumcision. The prepuce is slit up on the dorsum of the clitoris, as would be done in a similar operation on the male, or as is done in the initial step of clitoridectomy. The prepuce, now divided into two flaps, is cut away by seizing first one flap and then the other with a forceps and cutting it off at its base with the scissors (Fig. 77). The exposed raw surfaces are closed by a series of fine catgut sutures (Fig. 78).

CHAPTER XIX

NEOPLASMS OF THE EXTERNAL GENITAL ORGANS

(A) Benign neoplasms of the pudendum: Varices, fibromyomata, pure myomata, myxomata, lipomata, enchondromata, neuromata, cysts—Benign neoplasms of the vagina: Cysts, fibromata—Treatment—(B) Malignant neoplasms of the pudendum: Carcinomata, sarcomata, melano-carcinomata—Malignant neoplasms of the vagina: Sarcomata, carcinomata—Treatment: Excision—Clitoridectomy—Extirpation of the vagina.

Benign Neoplasms

The pudendal organs, like other parts of the female genitalia, may become the seat of neoplastic diseases. These neoplasms, from a histopathological standpoint, are to be divided into connective-tissue tumours and epithelial new growths. For practical purposes it seems advisable here to separate the nonmalignant from the malignant new growths. Among the former there will be included in this consideration some pathologic conditions which, strictly speaking, do not belong to the tumours at all.

Benign Neoplasms of the Pudendum.—It is a matter of doubt whether true *hemangeiomata*—i. e., tumours developing from and characterized by a new formation of blood vessels—have been observed in the pudendal organs. There are to be found, however, in literature very few reports according to which true neoplastic angeiomata have been observed in the vulva.

The condition frequently found and described as *varicose tumour* of *the vulva* is not a genuine neoplasm, but represents varicosities due either to local or to general disturbances of circulation (Fig. 79). All circulatory disturbances of the lower half of the female body have a tendency to lead to marked manifestations in the vulva, its great supply of blood vessels favouring very much venous stasis and the formation of varicosities. Pregnancy is a most fruitful cause of enlarged congested veins in the pudendal organs. We then find the veins of the labia majora greatly congested and dilated, and they rise as prominent purple swellings over the level of the surrounding skin. Large tumours of the ovaries, as well as fibromyomata of the uterus, may produce similar swellings. Valvular lesions of the heart, as well as nephritis, cause enormous œdema of the vulva and produce swellings of the labia majora that attain at times great dimensions. Chronic

inflammatory conditions in the pelvis also lead occasionally to varicosities of the pudendum. The greatly dilated and enlarged veins may undergo secondary changes, as phlebitis and fatty or calcareous degeneration, when there may occur, even in the absence of any appreciable force or insult, spontaneous hemorrhage into the tissues; a *hematoma vulvæ* is thus established. (See Injuries of the Vulva.)

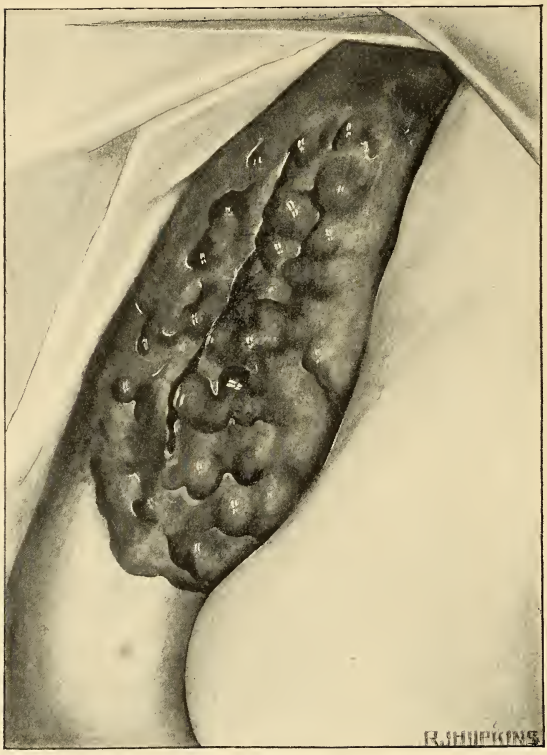

Fig. 79.—"The condition frequently found and described as varicose tumours of the vulva."—Herzog (page 221).

Among the benign true tumours of the vulva the *fibromata* and *fibromyomata* are probably the most common, though they are by no means frequently met with. These new growths take their origin from the subcutaneous connective tissue of the labia majora and labia minora, more rarely from the clitoris. They form hard, somewhat nodular, roundish, oval, or elongated masses, covered by normal skin. Histologically these tumours consist of newly formed, wavy, fibrous, connective tissue, very poor in nuclei, which is surrounded by a capsule made up of a condensed tissue of the same type. The skin is generally somewhat movable over the capsule and is not much changed in its structure and appearance. The tumour proper frequently contains, besides fibrous connective tissue, nonstriated involuntary muscle fibres or cells, so that the neoplasm assumes the character of a fibromyoma.

Pure *myomata* of the vulva are very rare, though they have been observed occasionally. While the tumours of the fibromyomatous group are, as a rule, firm, hard, and solid, there may occur in them, in consequence of lymph stasis, lymphangeiectatic spaces of large extent. In a case of this kind, diagnosis between fibromyoma and elephantiasis may be impossible without the aid of a microscopic examination. The latter, however, will clear up the diagnosis. The fibromata show a

well-circumscribed proliferation and new formation of connective tissue, while in elephantiasis the hypertrophic processes of the connective tissue are diffuse and infiltrating, and there are also characteristic changes in the skin, which is practically unchanged in fibroma and fibromyoma.

These tumours, as has been shown recently, frequently do not arise from the pudendal organs proper, but from the round ligament, and only later on in their growth and development descend into and encroach upon the pudendum. Fibrous tumours starting primarily from the fascia of the pelvis may likewise in the course of their development and growth descend into the pudendum and present as tumours of the latter.

The fibromata and fibromyomata of the pudendal organs have been observed at all ages from about the age of puberty until long after the climacteric period. They may be single or multiple. Their growth is usually slow, but they may become very large in size, reaching down to the knees, and weighing as much as fifteen pounds and more. When these fibrous tumours attain a large size they have a tendency to become pedunculated. Some fibromata show a pedunculated character from the start, forming small, elongated projections from the integument of the labia majora. They have been described as *fibroma molluscum* or *molluscum pendulum* of the vulva.

The larger fibromata of long standing are apt to become ulcerated on the surface by pressure and lack of proper care and cleanliness. They are also liable to undergo calcareous degeneration. Another secondary change to which they may become subjected, consists in an extensive œdematous infiltration, in consequence of which the fibres composing the neoplasm become pushed apart. Such tumours are not hard, but rather soft; they may even show pseudo-fluctuation, and microscopically their tissue looks very much like a myxoid degeneration, though it really only represents an extensive œdematous infiltration. Fibromata so changed have frequently been reported as *myxomata* or *myxofibromata*.

Lipomata of the vulva are rare. They are occasionally found in the mons veneris or in the labia majora and form well-differentiated roundish tumours. They are very much softer than fibromata, and, like them, are sometimes pedunculated. Like the fibromata, the lipomata of the vulva have a tendency to increase rapidly in size during pregnancy, to again somewhat decrease after the termination of gestation. A very few cases of congenital lipoma of the labium majus have been reported.

Enchondromata and *neuromata* of the vulva have been described, but since these reports are not based upon a microscopic examination, they can not be accepted as valid evidence of the actual occurrence of such tumours.

Cysts of the vulva may here receive some mention, although they are almost without exception not true neoplasms, but mere retention cysts. The cysts found most frequently in the region of the vulva are

developed from the glands of Bartholin, either from the gland proper or from its secretory duct. (See Vulvo-vaginal Gland.)

Other cysts similar in character to those of the vulvo-vaginal gland take their origin from *Gärtner's duct*, which, as is well known, occasionally extends downward into the vulva.

There are also sometimes found in the labia majora atheromatous cysts and dermoids. They are lined internally by squamous and sometimes by cylindrical epithelium; acinous glandular structures have been described in connection with such cysts. Small, yellowish, translucent cysts, observed not uncommonly on the hymen, are, as their structure and contents show, retention cysts of sebaceous glands. There have also been observed on the hymen small multiple cysts of the character of lymphangeiectatic formations. Aside from the cysts of the vulvo-vaginal glands due to gonorrhœal infection, cysts of the pudendal organs, as before described, have no important practical bearing; they are generally discovered only accidentally, not giving rise to any symptoms. In rare cases larger cysts of this type may give rise to slight inconveniences in consequence of their size.

Benign Neoplasms of the Vagina.—*Cysts of the vagina* are not so very uncommon. According to the statistics of Neugebauer, they are found in one of every six hundred women presenting themselves for examination. They are usually solitary, and when multiple rarely more than three or four are present, which tend to arrange themselves in rows. Most frequently they are found in the upper part of the vagina, especially growing from the anterior wall, though they may develop in the lateral walls, as well as in the lower part of the vagina. They vary in size from a pea to a hen's egg, though Veit has reported a case in which the cyst reached the size of a fœtal head. In most instances, however, they tend to grow slowly, and rarely reach a large size.

Age appears to have no influence in their etiology, as they occur in virgins as well as in women who have borne children. Many theories have been advanced in explanation of the origin of these cysts. Huguier and Guérin thought they always grew from glands which were present in the walls of the vagina. In later years the tendency has been to regard all cysts of the vagina as having their origin in the remains of the Wolffian bodies. While a certain proportion of cysts no doubt originate in this manner, this theory fails to explain the origin of many cysts which develop in locations remote from such embryonal structures and which are very superficial. More recently Preuschen was able to demonstrate the actual existence of ductlike glands in a number of cases examined post-mortem, which were lined with columnar epithelial cells, from which fact he attributed to those cysts occurring in locations other than the anterior or lateral walls of the vagina a glandular origin. It is evident, therefore, that we must admit the glandular theory as explaining the origin of a certain proportion of smaller cysts, while most of the larger cysts develop from the

embryonal remains of the Wolffian bodies. In addition to these theories, the possibility of dislocation of islands of epithelium which become embedded in the subcutaneous tissue, the result of trauma—as, for example, childbirth, or operations on the vagina, which afterward give rise to cysts—must always be borne in mind. Finally, *dermoid* cysts may develop in the wall of the vagina, usually in the recto-vaginal septum.

Cysts of the vagina are rounded tumours, frequently biscuit-shaped, hemispherical, or fusiform, with tense elastic walls encroaching on the lumen of the vagina. Rarely they may assume a polypoid shape, having protruded to such an extent as to form a pedicle (Fig. 80).

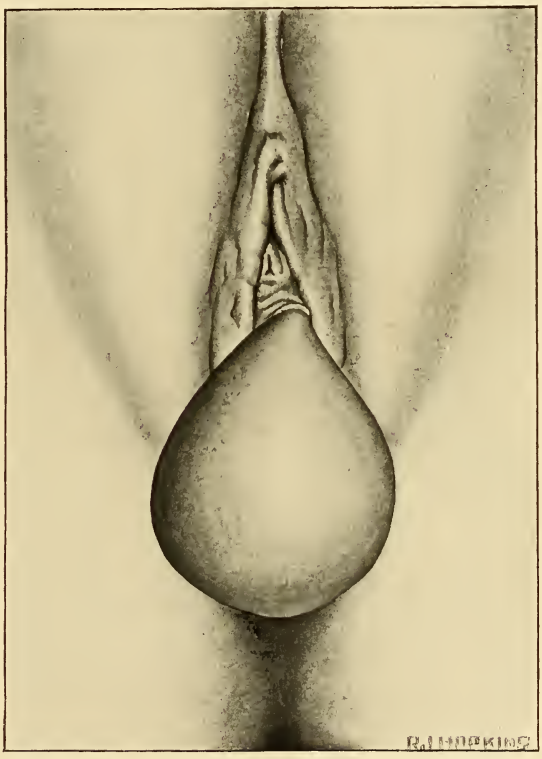

Fig. 80 (Reed).—"They may assume a polypoid shape having protruded to such an extent as to form a pedicle."—Rothrock.

The cyst wall varies much in thickness. In case the cyst is large the wall may be very thin and the contained fluid of a clear colour, giving the cyst a bluish translucent appearance.

The cyst contents are usually a thin, clear, yellowish, transparent fluid, though they may be viscid, turbid, and even of a dark-brown colour from the presence of disorganized blood. Microscopically, the cyst contents are poor in organized elements, though occasionally there are to be found mucous corpuscles and groups of desquamated epithelial cells, cylindrical and squamous, together with cholesterin crystals and fatty detritus. Should the cyst become infected by pyogenic micro-organisms, suppuration takes place, and the contents will then consist largely of pus.

Vaginal cysts are usually simple, though occasionally the remains of septa may still be observed. Rarely, multilocular cysts have been described, Poupinel having met with one composed of fifteen small

cysts. On microscopic examination the cyst wall is made up largely of fibrillary connective tissue, though in a certain number of cysts, smooth muscle fibres are present, more or less uniformly distributed. Great difference is noted in the epithelial lining of vaginal cysts. Usually it consists of a single layer of columnar epithelial cells, which may be ciliated. Occasionally the epithelial lining is polymorphous, consisting of cuboidal, cylindrical, and squamous cells, or the cylindrical cells may be entirely replaced by the squamous type. Veit attributes this change, especially when the cysts are large, to the pressure of the cyst contents. In a few instances invaginations of the epithelial lining into the cyst wall have been observed, the occurrence of which has been advanced as proof of the glandular origin of such cysts.

Fibroids are the rarest of all neoplasms of the vagina. They are usually rounded, very rarely reaching a size larger than an orange, though tumours weighing as much as two pounds have been observed. They are almost invariably solitary and usually sessile, only exceptionally forming a pedicle. Their favourite location is the upper portion of the anterior vaginal wall. The *etiology* of these tumours is still obscure. They are most frequently met with in middle life, though they have been observed in children. Von Recklinghausen has advanced the theory that these tumours are in reality adenomyomata, which have their origin in the remains of the Wolffian ducts, which view, however, still lacks confirmation.

These tumours grow from the fibrous or muscular coat of the vagina, and are usually embedded in a fibrous capsule. Their histologic structure is identical with that of fibroids of the uterus, consisting largely of connective-tissue bundles with a rather sparse intermixture of smooth muscle fibres. Striped muscle fibres are occasionally to be seen, in which case the tumour must be classed as sarcoma, especially when occurring in children. The mucous membrane covering the tumours is usually intact, unless destroyed by pressure, when they will present ulcerated surfaces. Fibroids of the vagina may become œdematous, or gangrenous and sloughing, and may be cast off in this manner. *Polypi* are simply fibroids which have become pedunculated. They do not differ essentially in structure from fibroids.

The **treatment** of benign neoplasms of the external genital organs represents some of the least difficult problems in surgery. Varicose tumours of the vulva, when they exist simply as enlargements of the veins and are not associated with extensive hypertrophy of the connective tissue, should be treated by obliteration of the veins. This to be effective must be done thoroughly. When the varices are restricted to the vulva, the larger trunks of the veins are easily detectable and may be tied by subcutaneous ligature. The ligatures should be applied at intervals along the same vessels, and the vessels themselves should be divided between the ligatures. The same principle of treatment may be applied to perivaginal varices, although the technique is rather more difficult. When pudendal varices are associated with extensive hyper-

trophy, the hypertrophied area may be excised. In many of these cases the varicose condition of the external veins is but an index of the condition of all the veins surrounding the vagina and extending far up into the pelvic structures. The control of such extensive conditions is very difficult, if not impossible. Fibromyomata and cysts of either the vulva or vagina should be treated by extirpation.

Malignant Neoplasms

Malignant Neoplasms of the Pudendum.—Malignant tumours of the vulva are comparatively rare. If we remember how frequent these neoplasms are in other parts of the female genital organs this must excite our comment. Schwartz collected 1,177 cases of carcinoma of the uterus and the vulva. Of these, only 30 cases belonged to the latter class; the rest were all carcinomata of the uterus. We are not, however, in a position to account for the comparative rarity of malignant neoplasms of the pudendal organs.

Carcinoma, which we will consider first, is much more frequent than sarcoma.

Nothing definite is known as to any predisposing cause, except the advanced age of the patient. Winckel, who has seen 8, and collected from the literature 54, cases, found that 6 cases occurred in women under forty years; 16, between forty and fifty; 20, between fifty and sixty; and 20 cases in women over sixty years. It can not be shown that simple inflammatory processes or gonorrhœa and syphilis exert any predisposing influence with reference to the development of carcinoma of the vulva. The starting points for these tumours are the clitoris, labia majora and labia minora, the perineum, and rarely the glands of Bartholin. In the case of the latter the carcinoma has a glandular, in all other cases a squamous, epithelial-celled type. These tumours are generally characterized by an extensive new formation of tissue, by their inclination to early superficial ulceration, hard diffuse infiltration of the surrounding tissues, and involvement of the neighbouring lymph glands, particularly those in the inguinal region. The glandular involvement, however, in some cases does not seem to supervene early.

The carcinomata of the vulva, from certain macroscopic features, may be divided into several groups, which are, however, not distinguished by fine microscopic differences. One form is characterized by a prominent tumour formation. The affected portion of the vagina presents a roundish tumor, generally of moderate size, usually not larger than a hen's egg or an apple. It is firm and hard in consistence, situated in the upper layers of the integument, and more or less movable on the subcutaneous tissues. The surface is formed by an epidermis, which has a tendency to form warty prominences and papillary excrescences. If these tumours are seen somewhat later they are not so freely movable and their surface has become ulcerated. A second

form takes on from the start the shape of a diffuse infiltration, which does not project materially above the level of the surrounding skin. On palpation of the neoplasm its site is found to be hard, and it is not freely movable, but, on the contrary, is firmly fixed to its surroundings. This variety likewise soon begins to ulcerate; its surface either shows a mass of shallow, uneven granulations, or a ragged tissue covered with a bloody, dirty, purulent exudate. The third form from the beginning has a marked tendency to ulceration, and presents a *deep craterlike ulcer* with hard, infiltrated, overhanging edges.

Microscopically, carcinoma of the vulva presents a typical squamous epithelial-celled cancer. The epithelia of the stratum germinativum proliferate into the underlying connective tissue in the form of pegs or cylindrical masses, and these have a tendency to become branched. The proliferating cells speedily undergo cornification, and one therefore finds in carcinoma of the vulva epithelial pearls or "onion bodies" in great number and very typical in appearance. The younger epithelia, which have not undergone cornification and have preserved a columnar type, together with the somewhat tubular branched character of the cell nests, may, on superficial examination, create the impression of a glandular, tubular carcinoma. This impression is, however, erroneous, for carcinomata of the vulva are true squamous-celled neoplasms, not glandular carcinomata, but "cancroids."

When after removal of the original tumour a recurrence takes place, the latter frequently loses the characteristic structure of a cancroid, and presents a tissue composed of a fibrillar stroma with only small epithelial nests in which epithelial pearls are absent. There are frequently found in the neighbourhood of carcinoma of the vulva, near the primary tumour or near recurring metastasis, whitish patches of epidermis, which condition is known as *leucoplakia*. These spots microscopically show a thickening of the epidermis. They are not characteristic of carcinoma of the vulva, since they are also found in other conditions.

Carcinoma of the vulvo-vaginal glands, of which a few cases have been reported, forms a hard tumour situated under the unchanged labium majus. Microscopic examination shows an alveolar carcinoma with remnants of normal glandular tissue of the organ.

Carcinoma of the vulva after it is once well established generally spreads quite rapidly and has a tendency to grow around the urethra into the vaginal walls, into the pelvic fascia, and into the perineum. Involvement of the other labium majus from the opposite one originally affected has likewise been several times observed. The prognosis of carcinoma of the vulva appears to be somewhat better than that of cancer of the vagina, but recurrence and final death is the rule even after thorough removal. Goffe has reported a case of primary epithelioma of the clitoris followed by speedy lymphatic involvement. A section taken from a case of Whitacre's shows a typical microscopic picture of epithelioma of the clitoris (Fig. 81).

Sarcoma of the vulva is very rare. The number of cases of this kind which have been reported is very small. These connective-tissue neoplasms are, as a rule, very malignant, and there are few well-authenticated cases on record of permanent cure after the removal of a sar-

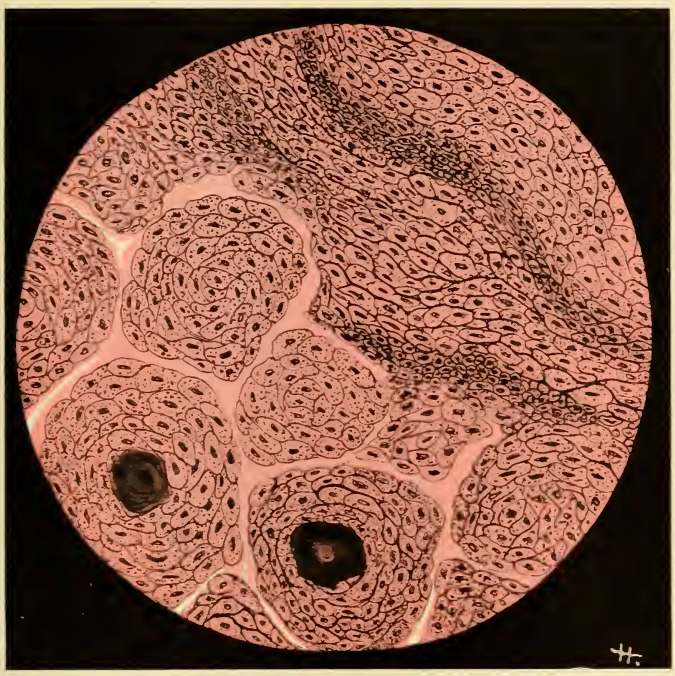

Fig. 81.—"A section taken from a case of Whitacre's shows a typical microscopic picture of epithelioma of the clitoris."—Herzog (page 228).

coma of the pudendal organs. The sarcomata of this region usually present themselves as large spherical tumours arising from the labia, the clitoris, or the region of the external meatus of the urethra, or they may first be observed as deeply pigmented warts on the labia. There have been described round- and spindle-celled sarcoma, myxosarcoma, and melanosarcoma. The latter is the form most frequently observed on the vulva. Winckel, among ten thousand female patients, saw only two cases of sarcoma of the vulva. One case was that of a pregnant woman, twenty-five years old, with a tumour the size of a man's head, which was hanging down from the vulva, suspended on a pedicle the size of a child's arm. This tumour had not been very malignant, since it had been present and growing for eight years. Its microscopic examination showed it to be a round-celled sarcoma. Winckel's second case was a myxosarcoma. Bruhn operated in two cases of fibrosarcoma, and claims that he obtained a permanent cure. Wernitz reported a case of spindle-celled sarcoma. Robb has described a myxosarcoma. Ehren-

dorfer has seen a small round-celled sarcoma springing from the anterior part of the meatus urinarius and protruding between the labia. Older reports have been furnished by G. Simon and a few others. There have been reported altogether about a dozen cases of this kind. Somewhat more numerous are the reports of cases of melanosarcoma. It is a well-known fact that the vulva is frequently the seat of pigmented spots and pigmented nævi. These occasionally become the starting point of melanotic sarcoma, which is generally of a most malignant type. Other melanosarcomata of this region do not begin in superficial pigment spots or nævi, but in the deeper layers of the mucous membrane. They are first noticeable as a purplish spot, which spreads, becomes deeper in colour, and then assumes the shape of a simple wart or of a branched papillomatous growth. Haeckel reported a melanosarcoma of a deep bluish-black colour springing from the labia minora and the clitoris. Müller described a tumour of this kind arising from the clitoris. Most cases reported took their origin from the labia majora. All the melanosarcomata of the vulva observed were characterized by a deep pigmentation; they were moderate in size. As a rule, they soon reappeared after removal and speedily led to the formation of multiple metastases. Sometimes general sarcomatosis, cachexia, and death, soon

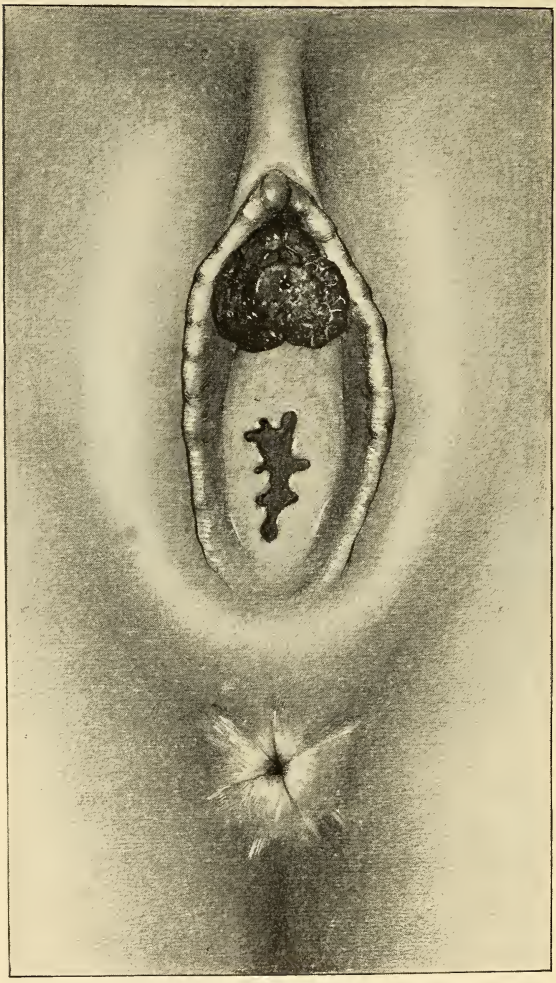

Fig. 82.—"Reed has removed a trilobular melanosarcoma from the meatus urinarius of a young girl."—Herzog (page 231).

follow operative procedures. Reed, however, has removed a trilobular melanosarcoma from the meatus urinarius of a young girl with complete success (Fig. 82).

Histologically, these new growths generally are composed of round cells; occasionally spindle cells are found. The cells contain in their protoplasm a great amount of a brownish granular pigment, which is also found free between the cells composing the tumour (Fig. 83).

Fig. 83 (Reed).—"A brownish granular pigment, which is found free between the cells composing the tumour."—Herzog.

Melano-carcinomata of the vulva, likewise very malignant in character, have been described. Dr. Balfour Marshall has reported (*Glasgow Medical Journal*) the case of a widow, aged fifty-seven, in whom the site of the clitoris was occupied by a dark-bluish and bluish-red, slightly lobulated tumour, of the size of a small walnut. The growth was removed and was found to have originated in the clitoris and præputium clitoridis, being "a melanotic sarcoma with some hemorrhage into its substance." Dr. Marshall was able to find records of only nineteen cases of sarcoma of the vulva, of which two started in the clitoris.

Malignant tumours primarily situated elsewhere in the body not infrequently form metastases in the vulva. Carcinomata and sarcomata of the uterus lead to metastases in the pudendal organs, as also, at times, do malignant neoplasms of the ovaries and of the urinary bladder. Syncytioma malignum of the uterus, which so frequently forms metastases in the vagina, is also liable to form metastatic tumour masses in the vulva. Aschoff reports a case of syncytioma where the original tumour has made a metastasis in the left labium majus.

Malignant Neoplasms of the Vagina.—(*a*) *Sarcoma in Childhood.*—Primary sarcoma of the vagina occurs at any period, in infancy as well as in adult life, and, since there is a very great difference in its appearance and mode of development in the two ages, allowing a sharp subdivision, it is customary among writers to treat these subdivisions separately.

In children, as in adults, it is a rare disease, and usually manifests itself during the first two or three years of life. Gränicher observed a case in a newborn child, which, however, advanced very slowly and did not prove fatal until the seventh year of life.

Sarcoma in children commonly appears in the form of polypoid or grapelike protrusions, usually springing from the anterior wall of the vagina. In the beginning, the tumour is rounded or hemispherical with a broad base, but it tends to become polypoid as the disease advances. It is generally of a cherry-red colour, but it may be dark brown if very vascular. Soon the surrounding mucous membrane becomes infiltrated and here and there in the surrounding structure secondary nodules begin to develop. Sarcoma shows a marked tendency to infiltrate the vesico-vaginal septum and invade the bladder, and may, from pressure on the urethra, or infiltration of the neck of the bladder, cause urinary stasis with resulting dilatation of the bladder and nephydrosis. In advanced cases the tumour is very prone to undergo ulceration or necrosis with resulting infection of the genito-urinary tract, which ultimately reaches the kidneys, terminating in pyelonephritis. Rarely, the infection may extend to the uterus, and even to the peritoneal cavity. The recto-vaginal septum may also be involved.

Metastasis to distant parts of the body has not been observed, though regional metastasis to the inguinal glands and ovary has been met with.

Histologically, the tumour may consist largely of connective tissue, or it may assume the type of myxosarcoma. The sarcomatous element may consist of round or spindle cells, or both may be present. Occasionally giant cells are observed, and not infrequently striped muscle fibres are to be seen. According to Kolisko, striped muscle fibres are usually present, but other observers have failed to confirm this view.

The *etiology* is unknown. However, since it begins in infant life, Veit (*Handbook*, p. 355) regards it as probable that in some cases at least it is congenital. Kolisko also regards the presence of striped muscle fibre as evidence of congenital origin.

(*b*) *Sarcoma in Adults.*—Primary sarcoma of the vagina occurring in adults belongs to the rarer tumours. Up to the present time but thirty-one cases have been reported. They have been observed between the ages of fifteen and eighty-two, though the larger proportion has occurred in persons under forty years of age. They most frequently grow from the anterior wall and are rather more frequent in the lower third of the vagina. They appear as more or less circumscribed tumours, which is the most common form, less frequently as a diffuse infiltration of the mucous membrane of the vagina, which tends to ulceration. In the circumscribed form the tumour is usually smooth, rounded or hemispherical in shape, and sometimes is encapsulated. The integrity of the mucous membrane covering the tumour is usually maintained until pressure from its increasing size produces ulceration.

Metastases to distant parts of the body have been observed, notably to the lungs and skin.

Of the *etiology* of these tumours we know as little as of sarcoma in general. They usually have their origin in the perivaginal connective tissue, or in the submucosa. Occasionally they originate in the blood or lymph vessels, when they are termed endothelioma. Cases of this kind have been reported by Klein, Kalustow, and Waldstein.

Histologically, sarcoma of the vagina in the adult may consist of spindle, round, or mixed cells, and occasionally giant cells are present. Sarcoma of the vagina is especially characterized by the tendency to recurrence after removal, and, according to Jung (*Monatsschrift für Geburtshülfe und Gynäkologie*, Bd. ix), only three cases are on record which have passed without recurrence a sufficient length of time after removal to be denominated cured.

The vagina may be secondarily involved by sarcoma, which primarily has its seat in some other region of the body, as, for example, the uterus. Especially is this so in sarcoma of the cervix, where secondary involvement of the vagina is almost the rule.

(*c*) *Carcinoma.*—Primary carcinoma of the vagina is not common. Gurlt, among 59,600 patients, found 114 cases. Unlike sarcoma, it is a disease of later life, and has not been met with under the age of twenty-five. It appears mostly as an ulcerating excrescence, with sharply circumscribed borders, and is most frequently located on the upper portion of the posterior vaginal wall. The surrounding mucous membrane is usually involved in a catarrhal inflammation, and is frequently eroded and bleeds on the slightest touch. Not infrequently a marked thickening of the mucous membrane in the neighbourhood of the carcinomatous involvement appears as a diffuse infiltration, manifested as a thickening of the vaginal walls encroaching upon the lumen of the vagina. At first it may involve only a segment of the vagina, encircling its entire circumference like a band. In these cases ulceration is only observed after a considerable length of time. In the diffuse variety the growth is at first slow, but eventually infiltration of the perivaginal connective tissue takes place and the growth may invade the bladder or rectum, or extend into the parametrium, involving secondarily the iliac and retroperitoneal glands, or, in case the growth is confined to the lower third of the vagina, the inguinal glands may become involved.

The *etiology* is obscure. In a few instances it has been observed to develop at the point of pressure from pessaries, especially where their long-continued use has caused ulceration. These cases have many points in common with carcinoma of the skin, which sometimes develops in the border of indolent ulcers. In the present state of our knowledge concerning the etiology of carcinoma, it is difficult to say just what influence the pessary has had as an exciting cause of the carcinoma, and whether the irritation following its use, or the ulceration by producing an atrium of infection, has been chiefly

instrumental we do not know. Microscopically, primary carcinoma of the vagina presents the characteristics of carcinoma growing from the skin and consists of squamous epithelial cells.

Secondary Carcinoma.—Secondary carcinoma of the vagina is of much more frequent occurrence, and may result from direct extension or metastasis. Most frequently it is secondary to carcinoma of the uterus, especially to involvement of the portio vaginalis. In carcinoma of the body of the uterus the vagina may be secondarily involved by implantation metastasis. Carcinoma of the rectum or bladder may secondarily invade the vagina, and occasionally metastasis to the vagina has been observed to follow primary carcinoma of the ovary. Secondary carcinoma of the vagina partakes of the nature of the primary growth and is identical in its histologic structure.

Treatment of malignant neoplasms of the external organs of generation resolves itself into radical and palliative. The *radical treatment* consists in the extirpation of the malignant growth whenever it is so situated that its removal can be accomplished with reasonable safety to the life of the patient and with a reasonable prospect of completeness. Malignant tumours of the vulvo-vaginal glands, those involving either labium, the vagina, or the clitoris, should be freely excised, care being taken to dissect out all indurated neighbouring lymphatics.

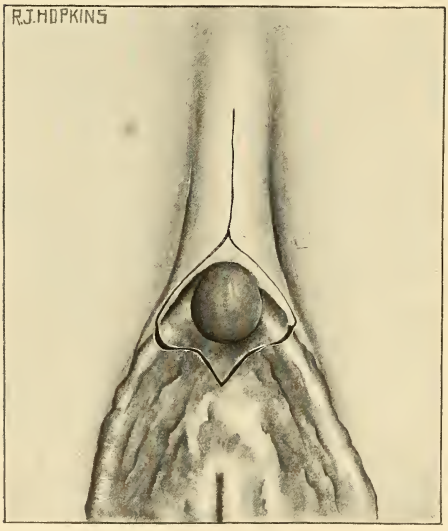

Fig. 84.—"The prepuce is then slit toward the pubis."—Reed.

Clitoridectomy, or excision of the clitoris, may be demanded for the cure of either malignant or tuberculous disease of that body; also for the removal of a malformed or hypertrophied clitoris, or for the relief of extreme nervous disturbances due to hyperæsthesia of that organ. The technique of the operation is as follows: Divide the tissues around the base of the gland by means of scissors, one blade of which is inserted beneath the integument, at the inner duplication of the preputial fold, and is carried entirely round the organ; the prepuce is then slit toward the pubis (Fig. 84); the clitoris is dissected out, but, before being excised, its base is clamped by a slender-bladed Kocher hemostatic forceps (Fig. 85); after which it is cut away, the vessels being controlled by ligatures. The flaps are approximated by buried

animal sutures and the margins of the wound are closed by the intercutaneous method. (See Figs. 38, 39.)

Extirpation of the vagina is sometimes practised in cases of primary carcinoma or of tuberculosis of that canal. Very satisfactory reports of the operation have been made by Olshausen, Dührssen, Martin (of Greifswald), and others. In the performance of this operation it may be necessary, as a preliminary step, in cases of narrow or indurated vaginæ, to incise the perineum, or even to carry the incision entirely through the perineum, round the anus, and up to the coccyx. As a rule, however, the operation may be done, as Martin directs, by making a preliminary incision round the hymenal ring at the introitus vaginæ. After this has been done, but little difficulty is experienced in enucleating the vagina by means of the finger, separating the entire canal from its underlying connective tissue clear to its juncture with the cervix. If the disease has not gone beneath the mucous membrane, the resulting disturbance of the blood vessels will not be so marked as to occasion serious difficulty in controlling the hemorrhage. If, however, the incision must be made through the perineum, round the rectum, and up to the coccyx, the hemorrhage from the hemorrhoidal plexus may be controlled only with some difficulty. After the vagina has been enucleated in the manner indicated, the remainder of the operation consists in the removal of the uterus and adnexa according to the technique described in Vaginal Hysterectomy. The proposition has been made by P. Müller to extirpate the vagina, leaving the senile uterus *in situ*; but as even the senile uterus is the source of some secretion which will accumulate above the tract of the vagina, which now becomes occluded, it is essential that even in these cases the uterus should be removed. Partial extirpation of the vagina has been practised by Fritsch and Asch, but the results have not been satisfactory. The method of Martin, as before described, is probably the safer, the operation being concluded by drawing down the peritoneum and stitching it all round at the introitus. After this step has been taken the vulvar orifice closes itself by transverse obliteration.

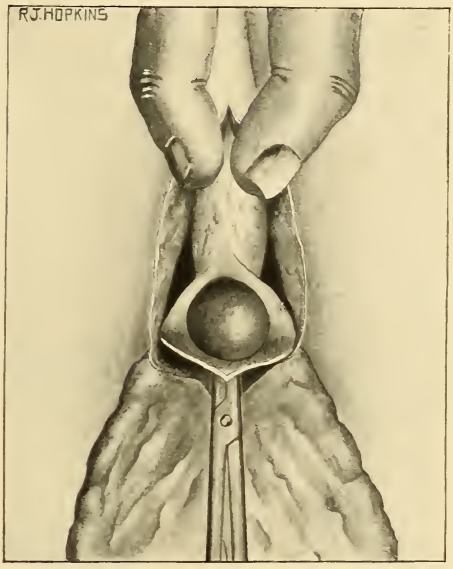

Fig. 85.—"The clitoris is dissected out, but before being excised its base is clamped."—Reed (p. 234).

The *palliative treatment* of malignant neoplasms of the external genital organs consists in making the patient as comfortable as possible during the persistence of the disease, and should be adopted as a line of practice only in cases that are either awaiting operation, or that have ceased to be suited to it in consequence of the extension of the disease. Of the latter class may be mentioned as examples carcinoma of the vagina invading and penetrating the recto-vaginal septum, thereby causing a recto-vaginal fistula, or other cases, again, in which the disease has perforated the bladder. These are distinctly hopeless conditions, entirely beyond the reach of surgical art, their comfort, or the little that may be secured for them, depending on various palliative measures. Cleanliness is of the first consideration; douches of lysol or creolin are cleansing, antiseptic, and are better borne than the more irritating solutions of either carbolic acid or the mercuric bichloride. Excoriated surfaces may be dressed with sterilized white vaseline or other oleaginous product, a little lysol or creolin being incorporated with this agent if desired. Opiates in the form of rectal suppositories, or hypodermic injections of morphine, should be given whenever they are not contraindicated by the idiosyncrasy of the patient. These are cases for euthanasia.

CHAPTER XX

DISPLACEMENTS OF THE VAGINA

The vagina—Varieties of displacements—Cystocele—Rectocele—Urethrocele—Colporrhaphy, anterior and posterior.

The vagina is a canal lined with a mucous membrane partaking largely of the histologic elements of the integument, and is surrounded by some muscular striæ that are designated as the sphincter vaginæ muscle. The tube thus constituted extends from the vulva to the uterus and is surrounded by more or less loose cellular tissue. It is slightly curved, being concave anteriorly and convex posteriorly. It is held in position, not alone by its attachment to its surrounding cellular tissue, but more particularly by its attachment to the uterus and the pelvic diaphragm, and by the support which it derives from the perineum. This canal is liable, in whole or in part, to **displacement.** *Upward displacement* may occur, as in the case of a large fibroid tumour, the growth of which carries it above the pelvic brim, causing it to drag the vagina upward. This upward displacement may occur to such a degree as to exercise more or less tension, even upon the lower segment of the canal. *Downward displacement,* or a prolapse of the vagina or some part of it, is the condition more frequently encoun-

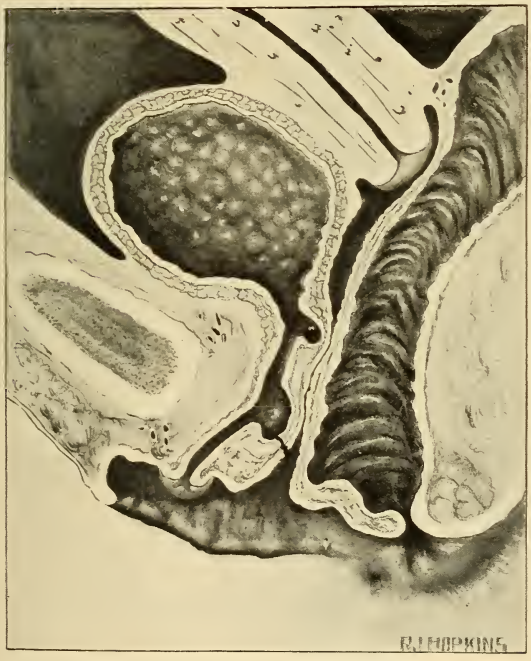

Fig. 86.—"Sacculations may occur from the urethra, a condition called urethrocele."—Reed (page 238).

tered. The *causes* of prolapse of the vagina, or of one or the other or both of its walls, may exist either in the pelvic diaphragm or in the pelvic floor. Weakness of the pelvic diaphragm—a condition which depends upon the loss of the retentive power of the pelvic fascia—is generally manifested primarily by *descensus uteri*. When this condition occurs it is always and necessarily associated with more or less descent of, at least, the upper segment of the vagina. This is generally specially marked in relaxation and descent of the floor of Douglas's pouch. Occasionally this condition of the pelvic diaphragm, with its associated hysteroptosis, is sufficient to cause more or less descent of the anterior vaginal wall. Relaxation of the pelvic floor or the enlargement of the vaginal orifice by laceration of the perineum may, by removing the support from the superimposed structures, induce a similar prolapse of the vaginal wall. When the anterior vaginal wall folds inward it forms a sort of pouch from the bladder and is, therefore, designated a **cystocele**; when the posterior wall folds into the vagina and forms a pouch from the rectum, the condition is designated a **rectocele** (Figs. 86, 87). Similar sacculations may occur from the urethra — a condition called **urethrocele** (Fig. 86).

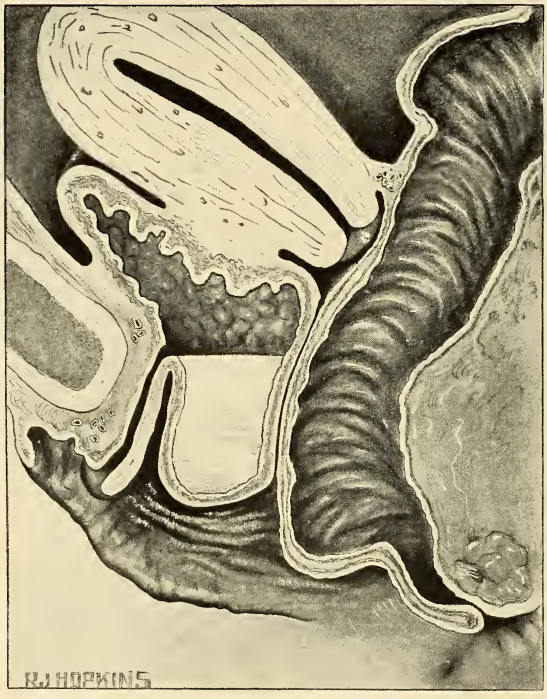

Fig. 87.—"There is always more or less residual urine remaining in the adventitious pouch."—Reed (page 239).

The *pathology* of these displacements, particularly of cystocele and rectocele, shows them as consisting essentially in an atrophy of the perivaginal muscularis, with a corresponding loss of its retentive power; and in a distention with resulting redundancy of the vaginal mucosa. The *symptoms* of these sacculations are very characteristic. In cystocele the patient is conscious of more or less distention of the vaginal orifice when she attempts to urinate; she experiences difficulty in completely emptying the bladder, often being forced to push that viscus upward with the finger before being able to empty it. When

this sacculation is extreme she may be unable to completely empty the bladder, even though she assists herself by the means indicated; under these circumstances there is always more or less residual urine remaining in the adventitious pouch (Fig. 87)—a condition which sooner or later results in inflammation of the bladder, with the usual pain and tenesmus. On inspection, a globular mass, which can be readily replaced by the finger and which increases in size and tension if the patient strains, will be seen presenting at the vulvar orifice. A curved sound, introduced through the urethra into the bladder, can be readily felt on the inside of this pouch, thus rendering certain the diagnosis of cystocele. In rectocele the patient when straining at stool feels as if she were about to defecate through the vagina, and finds it necessary sometimes to replace the protruding mass before she can empty the rectum. If the finger is introduced into the rectum in such a case as this it can be brought forward into the protruding pouch, which presents at the vulvar orifice as a globular mass, having the colour of the vagina and presenting the half-obliterated rugæ upon its surface. If the patient strains or coughs the protruding mass increases in both size and tension.

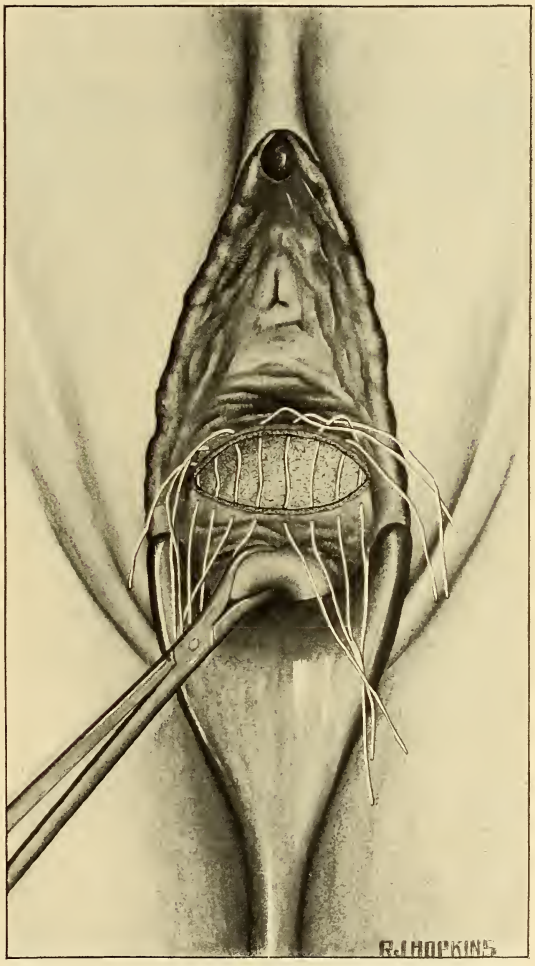

Fig. 88.—". . . Transverse denudations, so that the resulting line of approximation may be coincident with the normal folds of the vagina."—Reed (page 242).

The *treatment* of displacements of the vagina consists primarily in correcting, so far as possible, the causative conditions. When these

exist in the pelvic diaphragm, as when they depend upon prolapse of the uterus, the remedy is to be found in relieving the vagina of the abnormal pressure. This is generally accomplished by one or other of the recognised operations for the cure of prolapsus uteri. (See Surgical Treatment of Uterine Displacements.) *Pessaries* are, as a rule, more mischievous than otherwise; although their use may afford the patient a sense of temporary comfort. Those pessaries, however, which by their construction distend the vagina, or impinge forcibly upon any part of its walls, have a tendency to dilate the canal still further and render the original mischief more troublesome. In the place of pessaries it is usually better to employ tamponade with some astringent and antiseptic medicament. In cases of extreme rectocele or cystocele, or both, either combined or not with complete procidentia uteri, temporary comfort is derived from wearing a firm perineal support. Protruding vaginal surfaces frequently become excoriated, in which case they should be treated by careful cleansing and emollient applications. Such methods of treatment are, however, but tentative, cure depending upon such correction of the underlying cause and acquired morbid changes as can be effected only by surgical intervention. If the condition depends upon relaxation or en-

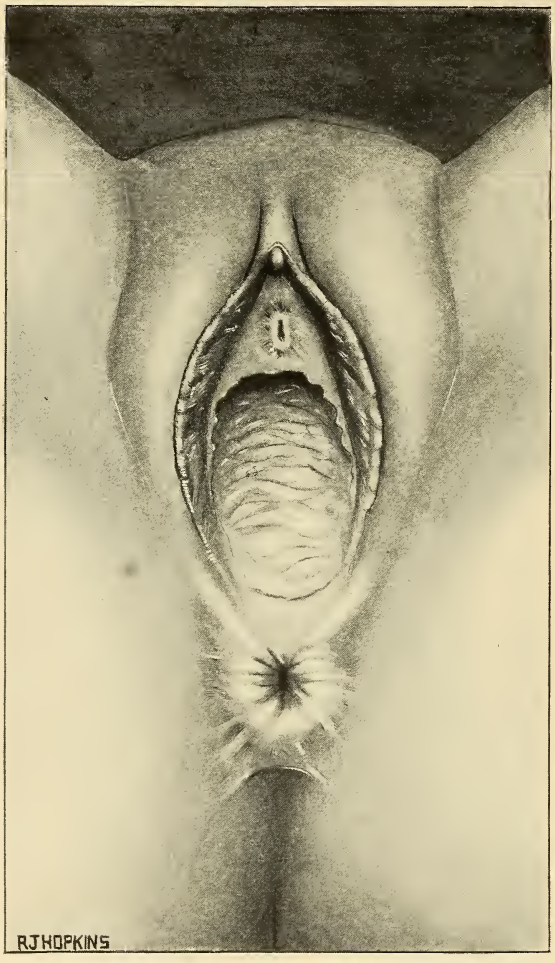

Fig. 89.—"There are cases, however, in which the anterior sacculation of the recto-vaginal septum exists without apparent injury to either layer of the pelvic floor."—Reed (page 242).

largement of the vaginal outlet, the latter resulting from laceration of the perineum or injury to the pelvic floor, the proper remedy is to be found in a restoration of the perineum or pelvic floor, associated, it may be, with a narrowing of the lower segment of the vagina. (See Perineorrhaphy.) This may need to be associated with the operation for either cystocele or rectocele, or both.

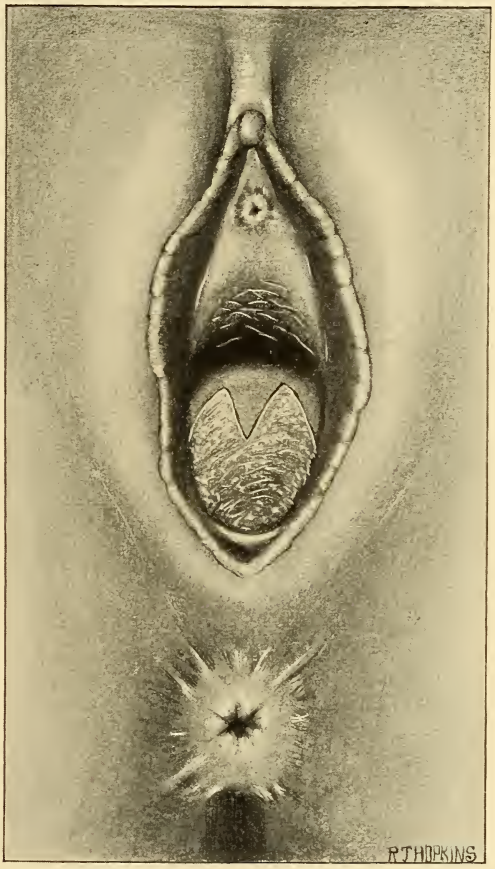

Fig. 90.—"In such cases the vaginal wall should be denuded."—Reed (page 242).

The *operation for cystocele* consists in narrowing the anterior wall of the vagina and, consequently, is called **anterior colporrhaphy.** It is accomplished, in general terms, by removing a disk of the redundant mucous membrane from the protruding vaginal wall, and in approximating the margins of the wound. The disk of membrane thus removed may be elliptical or circular in form, and may vary in dimensions according to the size of the cystocele. Fritsch removes a circular piece of membrane, from an inch to an inch and a half in diameter, from the most prominent part of the presenting pouch; this denudation is then encircled by a single tobacco-pouch suture which is drawn up and tied, the cystic wall being pushed upward into the bladder as the suture is tightened. The technique is very simple, and in cases of small cystocele the operation is very effective. It is not practicable, however, in very large protrusions, in which there is marked redundancy of tissue. In such cases it is better to remove an ellipse of tissue closing the wound by careful linear approximation of its margins. Operators differ as to the direction that should be given to the long axis of this elliptical denudation. They formerly made the long axis of the denudation coincident with the long axis of the vagina; but an increasing number of later operators prefer to make one, or

perhaps two, transverse denudations, so that the resulting line of approximation may be coincident with the normal folds of the vagina (Fig. 88). Experience seems to warrant the latter innovation, as there is less tendency to retraction and the results seem to be more permanent. The closure can be effected either by the interrupted, or the buried animal, suture. When the interrupted suture is employed it should be removed on the eighth or ninth day. (See Operative Treatment of Prolapsus Uteri.)

The *operation for rectocele* consists in narrowing the posterior wall of the vagina and, consequently, is called **posterior colporrhaphy.** It differs from the operation on the anterior wall, chiefly because rectocele as a rule exists as a complication of such conditions as call for the repair of the perineum or the restoration of the pelvic floor. The redundancy of tissue is reduced by removing one or more ellipses transversely from the vaginal wall and approximating the edges with interrupted sutures. (See Perineorrhaphy, Fig. 107). There are cases, however, in which the anterior sacculation of the recto-vaginal septum exists without apparent injury to either layer of the pelvic floor (Fig. 89). In such cases the vaginal wall should be denuded as indicated in Fig. 90, which is drawn from a patient in whom the conditions varied slightly from those in the case just mentioned. The mucous margins are then approximated by interrupted sutures, beginning first with one triangle, then with the other, thus forming the expanded arms of a Y. The remaining area is then approximated by passing the interrupted sutures from side to side.

CHAPTER XXI

THE VULVO-VAGINAL GLAND

Anatomy—Gonorrhœal infection—Abscess—Cysts—Carcinoma.

The vulvo-vaginal glands, or glands of Bartholin, are two small rounded or oval bodies from 15 to 20 millimetres in length, varying greatly in size and shape, and situated in the posterior third of the labia majora, one on either side of the lower end of the vagina, immediately below the bulb and in front of and near the upper margin of the perineal septum (Fig. 91).

Fig. 91.—"The vulvo-vaginal glands . . . are situated in the posterior third of the labia majora."—Rothrock.

They are racemose glands the acini of which are lined by a single layer of high columnar epithelial cells with basal nuclei. They secrete a muco-serous fluid which is emptied through two slender ducts of about 2 centimetres in length and terminating in small openings in the vestibule about 1.5 centimetre from the posterior median line just outside the hymen. These ducts are lined by low cuboidal epithelial cells and their mouths are plainly visible on close inspection, being of sufficient size to admit the passage of a fine probe. Functionally, the secretion of these glands serves to moisten the mucous membrane of the vestibule, and during sexual excitation or coitus it is discharged in considerable quantities. These glands become fully developed at the age of puberty, and maintain their full function until the climacteric, when they begin slowly to undergo atrophy and their function gradually ceases. The location of the mouths of these ducts renders them peculiarly liable to infection which may, by extension

through the duct, involve the gland and result in a series of inflammatory conditions constituting the chief diseases to which it is liable.

Inflammation must be regarded as invariably due to bacterial infection, and cases apparently the result of trauma, as for example those following on childbirth, are now generally explained by the preexistence of pathogenic bacteria in the duct, the trauma having served merely to afford an atrium of infection. While various bacterial flora of the vulva may gain entrance to these ducts, inflammation is almost invariably of gonorrhœal origin. The one possible exception to this is the staphylococcus, which, it appears, may produce inflammation either alone or in association with the gonococcus. All other bacteria, therefore, which may at times be present, must be regarded in the light of secondary invaders.

Pure gonorrhœal inflammation usually remains confined to the ducts, rarely involving the parenchyma of the gland, and then only slightly.

Gonorrhœal Infection of the Ducts.—Infection of the ducts may occur directly, but in the majority of cases it is secondary to infection of other portions of the genital tract. A well-developed case of gonorrhœal inflammation of the vulvo-vaginal gland has been observed fourteen days after exposure to infection (Bumm), but this is exceptional, and frequently weeks or months may elapse before the mouths of the ducts become infected although constantly bathed meanwhile with vulvar or vaginal secretions. In most instances both ducts are involved, frequently from the beginning, but almost invariably in cases of long standing. The ducts are usually involved throughout their entire length, though oftentimes the involvement is not uniform throughout, but some portions of the duct are more severely attacked than others.

To C. Herbert (*Inaugural Dissertation*, Leipsic, 1893) we are indebted for a description of the histological changes which take place in gonorrhœal inflammation of the gland and its duct.

They consist essentially of desquamation of the epithelial cells, with a small round-celled infiltration of the intercellular substance and subepithelial connective tissue.

At first the epithelium lining the duct becomes swollen, and eventually loosened, by the infiltration of leucocytes, then desquamation begins. In cases of long standing, the desquamated epithelial cells are replaced by cells more cuboidal in character, often approaching the squamous type. The lumen of the duct will be found filled with pus and desquamated epithelial cells in which gonococci may be demonstrated. The gonococci may penetrate to the subepithelial connective tissue but are not found in the infiltration cells themselves.

Gonorrhœal inflammation of the ducts either begins as a chronic process, or, after a brief and ill-defined acute stage, becomes chronic. It may persist for months, and even years, an ever-fruitful source of infection, and, indeed, together with infection of Skene's glands,

may constitute the only points of localization of the infection in women. It usually occurs some time during sexually active life, though Fischer (*Deutsche medicinische Wochenschrift*, 1895) has observed it in children.

Symptoms.—In the beginning, gonorrhœa of the ducts gives rise to few or no symptoms, so that the patient may be totally unconscious of its presence. Occasionally, there is a sensation of itching and burning and perhaps some slight sensitiveness on pressure, or the patient may complain of a dull pain increased on walking or sitting.

These symptoms when they occur are of short duration, and the patient may be conscious of nothing more than a slight muco-purulent discharge. Even this is often so slight as to escape notice.

On examination, if the labia are separated so as to bring the mouths of the ducts into view, these appear, in cases of recent infection, in the form of dark-red, glistening, moist, spots resembling small ulcers, this appearance being due to ectropion of the inflamed and swollen mucous membrane lining the duct.

If pressure is made along the course of the duct, a thin yellowish pus may be made to exude from its mouth, often in considerable quantities, which examination with the microscope shows to consist of pus and desquamated epithelial cells in which gonococci may be demonstrated in large numbers.

Occasionally a nodular swelling, or induration, due to an infiltration of the subepithelial connective tissue by small round cells, may be felt along the course of the duct.

When the disease becomes chronic, similar signs may be observed though less pronounced. The secretion now becomes more mucoid in character, and while gonococci may still be demonstrated they are present in diminished numbers.

Frequently the only remaining sign of infection is the appearance of the mouths of the ducts, which Sänger has compared with fleabites and has named "maculæ gonorrhœæ," since he regards them as an infallible sign of gonorrhœa.

Gonorrhœal inflammation of the ducts may terminate in abscess of the glands or in cyst formation, and these two conditions constitute the chief diseases of the vulvo-vaginal glands, inasmuch as gonorrhœal disease of the ducts is so devoid of symptoms that the patient is seldom conscious of its existence, and frequently it is only discovered by the examination of a physician.

Abscess.—Inflammation of the parenchyma is invariably due to infection by pyogenic bacteria, most frequently the *Staphylococcus pyogenes aureus*, occasionally the *Staphylococcus pyogenes albus*, either in association with the gonococcus or alone, and in a few instances the *Streptococcus pyogenes* has been found present (Dujon). In addition to these, various other bacteria are sometimes present in the pus, frequently the *Bacterium coli commune*; and in one case of relapsing abscess, examined by Rothrock, the *Bacillus pyocyaneus* was present,

together with the *Staphylococcus pyogenes aureus* and other undetermined bacilli.

The pus has frequently a foul odour similar to that so often met with in abscesses occurring about the anus, and in all probability due to the associated presence of the colon bacillus or putrefactive bacteria.

Inflammation of the gland is almost always secondary to inflammation of the duct, though Rothrock recalls a case which had been under observation for some time, in which there was no evidence of disease of the ducts, old or recent. In this case the *Staphylococcus pyogenes aureus* was found in pure culture and no gonococci were demonstrable in the pus.

Abscess of the gland may occur at any stage in the progress of disease in the duct, and, according to Bumm, it occurs in about one third of all cases of gonorrhœal infection of the duct. It is frequently met with in prostitutes, in whom gonorrhœal infection is unusually common. In this class of patients the traumatism incident to the abuse of coitus seems to be a fruitful exciting cause.

Not infrequently it is met with immediately following menstruation in the absence of any history of traumatism.

Abscess usually develops unilaterally and may occur on either side, appearing to have no predilection for one side over the other. In case the disease runs a very acute course, the parenchyma of the gland is quickly destroyed, and the infection may pass through the membrana propria into the surrounding cellular tissue, with a resulting phlegmon which terminates in suppuration with the formation of an abscess. Usually, however, the inflammation runs a less acute course and remains confined to the capsule of the gland, which quickly becomes distended with pus. In such cases the cellular tissue outside the gland becomes œdematous, and this in a large measure accounts for the swelling which is present.

Symptoms.—Abscess of the vulvo-vaginal gland as a rule begins abruptly, and manifests itself by swelling of the labia majora accompanied by the usual signs of acute inflammation—redness, heat, and pain. On examination, there may be felt in the posterior third of the labia majora, and often extending into the vagina, an irregular-shaped swelling the size of a pigeon's egg, and extremely sensitive on pressure. After a few days, during which the symptoms increase in severity, the swelling becomes boggy indicating beginning suppuration, and fluctuation may soon be felt. During this time the patient will usually find locomotion difficult on account of the swelling. The pain will have increased in severity, and have become throbbing in character. In severe cases there is usually a slight elevation of temperature reaching 101° or 102° F., and the onset of suppuration may be ushered in by a chill. There is usually some swelling of the inguinal glands on the affected side, which always indicates infection by pyogenic bacteria, as it is never present in pure gonorrhœal infection (Sänger). With the accumulation of pus, a gradual thinning of the skin and sub-

cutaneous tissue takes place, and the abscess, if not opened, points and ruptures spontaneously.

Perforation usually takes place on the inner surface of the labia majora, but the pus may be conducted forward between the layers of the ischiopubic fascia, and point in the fold between the labia majora and labia minora. In some cases, the abscess may be evacuated through the duct by pressure made in that direction; but this is exceptional, as the duct is usually occluded, or at least does not communicate with the main abscess cavity. Rarely the pus may burrow, and the abscess may be evacuated through the perineum, or even into the rectum with resulting fistulæ. The pus may be yellow, dirty-green, or chocolate-coloured from altered blood. It frequently has a foul odour, and may contain gangrenous shreds.

Well-defined abscesses are usually sharply limited by a thick pyogenic membrane, the inner surface of which may be smooth, or irregular from necrotic shreds, or from trabeculæ-like septa which separate the lobes of the gland. Inflammation of the vulvo-vaginal gland almost invariably terminates in suppuration, though occasionally cases are met with in which it is characterized by marked induration with little tendency to the accumulation of pus. In these cases, the induration may remain for a long time, and may serve as a focus of infection for renewed attacks under the stimulus of traumatism.

Cysts.—Cysts of the vulvo-vaginal gland are invariably the result of occlusion of the duct, and are therefore retention cysts.

The vast majority are secondary to gonorrhœal infection of the duct. According to Sänger, they are an almost certain indication of pre-existing gonorrhœa, while Winter maintains that they may result from occlusion of the duct by traumatism, as, for example, in childbirth.

Cysts may be located in the duct or in the gland. Those of the duct are small, superficial, and may remain for a long time without the patient's knowledge, being only discovered accidentally by examination. They are situated in the lower part of the labia majora and at first are fusiform, but later they tend to become spherical. Cysts of the gland proper are larger, and are more deeply situated. From the beginning, they are spherical in shape, and may develop in one lobule, or the entire gland may be converted into a cyst.

The wall of the cyst is usually thin and consists of connective tissue, and, occasionally, the remains of the epithelial lining of the gland may still be observed.

The cyst contents vary in character ranging from a thin clear serous fluid, to a thick, tenacious, or colloidlike, accumulation, varying in colour, sometimes clear or yellow, and, again, brown or chocolate coloured from the presence of altered blood.

Microscopically, they may contain blood corpuscles, leucocytes, epithelial cells, cholesterin crystals, and detritus, and frequently the presence of gonococci may be demonstrated.

As a rule, the older the cyst, the clearer will be its contents. In case the duct is not altogether occluded, pressure over the cyst may force out some of its contents, and occasionally cysts are met with which empty themselves spontaneously or during coitus, and which refill again after a time. In a few instances, cysts have been described which contained a fatty substance similar to that of sebaceous cysts. It is probable, however, that these were cysts which had their origin in the sebaceous glands of the vulva.

Occasionally, cysts are met with which contain gonorrhœal pus, the result of occlusion of the duct. Such collections have been termed pseudo-abscesses, as the usual signs of acute inflammation, such as are observed in staphylococcus infection, are wanting, except perhaps slight swelling which is due to œdema.

Cysts of the vulvo-vaginal glands may become secondarily infected by pyogenic bacteria, following on which, suppuration ensues and the cyst is transformed into an abscess, with the usual accompanying symptoms.

Cysts of the gland proper rarely reach a size as large as a hen's egg; and those especially large ones which have been described, the contents of which were clear and limpid, were probably in reality vaginal cysts from the remains of Gärtner's ducts.

Treatment.—Gonorrhœa of the ducts usually runs a very chronic course if left to itself, and, owing to the difficulty of access of the localized points of infection, often proves most obstinate to treatment.

First of all, cleanliness of the external genitals should be secured by antiseptic douches. The duct should be systematically evacuated each day by gentle pressure made along its course from within outward, after which an application of an 8-per-cent solution of nitrate of silver should be made by means of cotton wrapped on a slender probe. Good results also follow the use of a 2-per-cent solution of formalin applied in the same manner. When the lumen of the duct is very narrow or obliterated, it is sometimes best to lay it open along its entire length, and this is most conveniently done by a Weber's canaliculus knife such as is employed by oculists for division of stricture of the lachrymal duct.

When the duct has been laid open it should be washed out with an antiseptic solution, after which, either of the above-mentioned solutions of silver nitrate or formalin may be applied.

Pozzi recommends the application of a 2-per-cent solution of chloride of zinc or cauterization by a crayon of nitrate of silver, while others recommend cauterization with pure carbolic acid.

Inflammation of the gland is to be treated as is acute inflammation elsewhere, namely by rest in bed and by cold applications until suppuration, as is the almost invariable rule, occurs, when the abscess should be freely opened, washed out with an antiseptic solution, and packed with iodoform gauze to encourage granulation from the bot-

tom. As a rule the incision should be made over the most superficial point, which, in most cases, is the internal surface of the labium.

Kelly prefers, however, to make the incision over the skin surface so as to avoid a painful cicatrix which sometimes follows an incision made over the mucous surface.

As a rule, general anæsthesia will not be necessary for the opening of these abscesses, but local anæsthesia by chloride of ethyl, cocaine, or the application of ice, will be quite sufficient.

Cysts are best treated by extirpation, after which the opening should be immediately closed by interrupted sutures. In case this is not possible, after thoroughly laying the cyst open, an attempt should be made to obliterate its cavity by cauterization and packing with iodoform gauze. Examination should, at the same time, be made of the duct, and, if found diseased, it should also receive attention; otherwise it may remain as a source of infection.

Carcinoma.—One other disease of the vulvo-vaginal glands deserves mention, and that is carcinoma. While of rare occurrence, the number of cases which have been reported in recent years renders it certain that carcinoma may originate in the epithelium of the gland. Clinically, it appears to develop in middle or advanced life, as a rounded tumour of the labium which does not tend to ulcerate. Microscopically, the tumour frequently follows the type of adeno-carcinoma. Cases have been reported by Geist, Martin, Mackenrodt, Wolf, and Kelly.

The treatment here, as for malignant disease in other regions of the body, is its early recognition and complete removal.

In Martin's case the patient died of recurrence four years after the operation.

CHAPTER XXII

THE PELVIC FLOOR AND ITS INJURIES

The pelvic floor—The "pelvic diaphragm"—Injuries of the pelvic floor—Lacerations of the perineum—Restorations of the pelvic floor—Immediate operation—Instruments—Operations for incomplete lacerations, superficial—Emmet's operation, Reed's method of suture; modifications—Operations for complete lacerations; Tait's operation; modifications—Repair of deep injuries of the pelvic floor—Harris's operation.

The pelvic floor consists of those structures which by their muscular elements are attached to the lowest plane of the pelvic bones and which occupy the outlet of the pelvis. These structures considered in their entirety include integumentary, aponeurotic, and muscular elements, and are penetrated by three canals, namely, the vagina, the urethra, and the rectum. The function of the pelvic floor is to serve as a basis of support for the superimposed viscera. This power of support is exercised by virtue of the aponeurotic, and, particularly, the muscular elements of the floor; and it is to these elements that special attention is invited. The muscles of the pelvic floor are arranged in two layers, (*a*) external, and (*b*) internal. The *external layer* of muscles embraces the bulbo-cavernosus, the transversus-perinæi, and the sphincter-ani-externus muscle, with fibres from the pubo-coccygeus and the obturator-coccygeus muscles. These muscles meet at a central point of convergence, which may

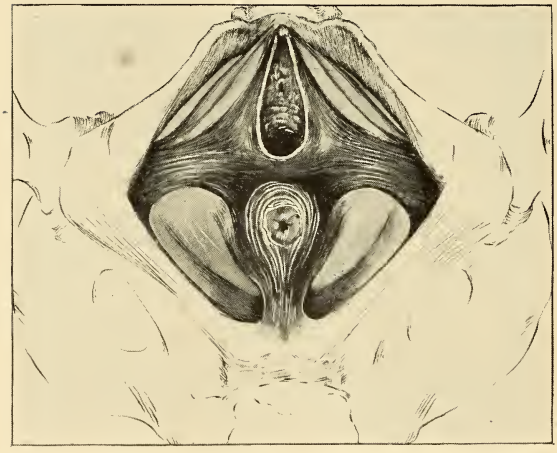

Fig. 92.—"These muscles meet at a central point of convergence, which may be designated the *nidus perinæi*."—Reed (page 251).

with propriety be designated the *nidus perinæi* (Fig. 92). The *perineum* proper is a pyramidal structure the base of which lies between the fourchette and the anus, while its apex blends with the recto-vaginal septum; its essential structures are derived from, and constitute a part of, the external muscular layer of the pelvic floor. The *internal muscular layer* of the pelvic floor occupies a plane about 1.5 centimetre above the external layer, and, as described by M. L. Harris (*Journal of the American Medical Association*), is composed of four paired muscles (Fig. 93).

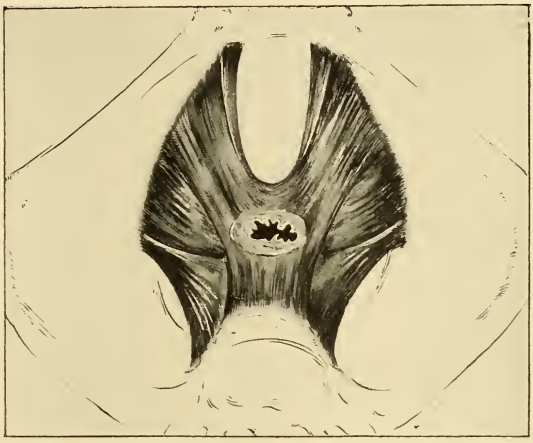

Fig. 93.—"The internal layer, as described by M. L. Harris, is composed of four paired muscles."—Reed.

Harris says that "it is not always easy in a human subject to draw sharp lines of demarcation between some of these muscles at all points, and some knowledge of comparative anatomy is necessary to a clear understanding of them. Comparative anatomy teaches us that these muscles are the representatives of well-developed, clearly defined muscles, which, in the lower animals are concerned in the movements of the caudal appendage, and which, owing to the loss of the caudal appendage and the assumption of the erect posture through evolution, have somewhat readjusted their character and attachments, to conform to their new function of closing the pelvic outlet and supporting the pelvic contents. These four muscles are called the ischio-coccygeus, the ilio-coccygeus, the pubo-coccygeus and the pubo-rectalis. The ischio-coccygeus which arises from the spine of the ischium and is inserted into the lateral border of the lower part of the sacrum and the upper part of the coccyx; and the ilio-coccygeus, which arises from the iliac portion of the obturator fascia and in inserted into the lateral border of the lower part of the coccyx, have comparatively little remaining physiological importance or surgical significance."

The remaining two muscles, however, are of extreme importance. "The pubo-coccygeus arises from the lower border of the symphysis ossis pubis, from the posterior surface of the os pubis, and from the obturator fascia as far back as the ilio-pectineal eminence. From this somewhat extensive origin the fibres pass meso-dorsad, passing by the urethra, the vagina, and the rectum, lying cephalad of the lower portion of the ilio-coccygeus, and are inserted with those of its fellow

from the opposite side by means of a tendinous expansion into the ventral surface of the coccyx and the lower part of the sacrum, the more ventral fibres interlacing directly with those of its fellow as a girdle posterior to the rectum. The pubo-rectalis lies beneath, or caudad of, the ventral portion of the pubo-coccygeus, from which it is separated ventrally by an intermuscular fascia. It arises from the lower portion of the symphysis ossis pubis, or from the beginning of the descending ramus and the cephalic surface of the urogenital fascia. Its fibres usually form a well-defined muscular loop which passes dorsad, encircling the rectum at the perineal flexure where it becomes continuous with its fellow. In passing by the rectum, some of its fibres enter the wall of the rectum, gradually become tendinous, and pass caudad as far as the cutaneous surface. A few fibres also pass anterior to the bowel between it and the vagina, some of them eventually becoming continuous with the transversus-perinæi muscle of the opposite side. The pubo-coccygeus and the pubo-rectalis together form what is generally termed the *levator-ani muscle*, and are the most important muscles of the pelvic floor. They produce the characteristic perineal flexure of the rectum and vagina and form the chief support of the pelvic viscera. They must undergo the greatest elongation during the dilatation of the pelvic outlet for the passage of the child, and, therefore, are most liable to suffer rupture or laceration, as will be shown later. The more ventrally placed fibres pass almost directly ventro-dorsad, while on frontal section the muscular plane slopes from the periphery toward the centre and cephalo-caudad. In the space between the opposite muscles ventrally pass the vagina and urethra, and it is extremely important to clearly understand the relations of these muscles to the lateral wall of the vagina. The normal virgin vagina is not a simple straight tube. In passing from without inward the general direction of the vagina, for a distance of 1.5 to 2 centimetres within the hymen is dorso-cephalad. At this point a distinct change in direction takes place and the vagina passes almost directly dorsad. The point of angulation lies opposite, and corresponds, to the perineal flexure of the rectum, and is produced by the pubo-coccygeus and the pubo-rectalis muscles encircling these canals at this point and drawing them forward, or in a ventral direction. With the finger introduced into the vagina, one is able easily to recognise the point of angulation, and distinctly to feel the edge of the pubo-rectalis muscle through the lateral wall of the vagina, as it passes in its course toward the symphysis.

"An incision through the lateral wall of the vagina 1 to 2 centimetres to the inner side of the hymen or its remains will expose the median edge of this muscle. It may easily be dissected up almost from its origin from the symphysis ossis pubis to the rectum, and in passing by the vagina its fibres do not enter or form an attachment directly to the vaginal wall. The muscle varies from 3 to 6 millimetres in thickness and extends in connection with the pubo-coccygeus laterally to the wall of the pelvis, the plane in the transverse direction being oblique

to the wall of the vagina. That portion of the vagina lying internal to the point of angulation or perineal flexure, and which composes by far the major portion of the canal, lies in its ventro-dorsal plane almost parallel with the muscular plane, and rests on it, the rectum alone intervening. Contraction of the muscles of this layer tends to increase the perineal flexure of the rectum and vagina by drawing the parts in a ventro-cephalic direction, and the opening through the muscular floor is thereby maintained ventrad of the line of gravity. The weight of the pelvic organs is thus brought to bear on the muscular layer of the pelvic floor; that mass of tissue ordinarily called the perineal body lying between the rectum and the vagina, and extending from the inner muscular floor of the pelvis to the cutaneous surface, has little or nothing to do with sustaining the pelvic organs." (Harris, *ibid.*)

The pubo-coccygeus and the pubo-rectalis muscles, considered jointly as the *levator-ani muscle*, are graphically described by Dickinson (*American Journal of Obstetrics*) as resembling a horseshoe. Without reference to accurate anatomical details he says that "it is like a sling attached to the pubes in front, its sweep reaching horizontally backward to encircle the rectum and vagina like a collar. It sustains the relation of an independent encircling constrictor to the rectum and vagina, both of which are drawn by it in the direction of the pubes. It is a voluntary muscle with the capacity of lifting from 10 to 27 pounds. In cases in which it is inordinately developed it may be a serious barrier to the sexual relations while its spasmodic excitation is the frequent cause of dyspareunia and vaginismus."

Meyer designated the internal muscular layer of the pelvic floor as the *diaphragma pelvis proprium*, and there has been a disposition among other writers to speak of this layer as the **pelvic diaphragm**. But this nomenclature is both erroneous and misleading. The word diaphragm, whether employed in mechanics or biology, conveys the meaning of "a partition or septum which separates one cavity from another." The most extravagant license can not conjure into existence a cavity below the internal muscular layer of the pelvic floor. If the term pelvic diaphragm is to be employed at all, it should be restricted to that partitionlike arrangement of structures at the utero-vaginal junction which divides the recognised cavity of the pelvis from the cavities of the vagina, rectum, and, in part, of the bladder.

Injuries of the pelvic floor may embrace any of the recognised varieties of wounds, such as contused, incised, or lacerated. They may be restricted to the skin, or they may involve the external muscular layer (perineum), or only the deeper muscular layer, or, to a greater or less extent, the whole of the structures of the pelvic floor. In this chapter we shall confine attention to those injuries which affect (*a*) the external muscular layer (perineum), and (*b*) the internal muscular layer.

Lacerations of the Perineum.—*Injuries of the external muscular* layer are chiefly restricted to the *perineum* and are ordinarily discussed under the title of *lacerations of the perineum.* These injuries rarely

result from external violence, but the traumatism upon which they depend is generally an incident of parturition.

The traumatisms inflicted in this region are generally considered and treated as lacerated wounds. Still, there are instances in which the injury may be classed both as a contusion and a laceration, and upon a proper conception of the true nature of the trauma the treatment will, in a great measure depend.

Varieties.—The varieties of these lacerations, or tears, must be considered from the standpoint of the direction taken by the tear. This will be governed by the presenting part of the child that comes in contact with the least resistant or most inelastic structure, the force of the labour pains, and the anatomic construction at the point of impingement.

It must be remembered that the perineal structure, as a whole, is a complex arrangement of muscles, ligaments or tendons, fasciæ, and vessels and nerves, so interwoven and superimposed as to resist a great amount of force. One of the functions of the perineum being to close the introitus vulvæ by the contraction of the sphincter vaginæ and levator-ani muscles, it is drawn or held forward by them, producing an abrupt angle with the lower portion of the birth canal; so that, in the process of descent, the presenting part comes into contact with a decided obstruction, and, should it be wanting in elasticity or resiliency, the structure is sure to be injured. A tear occurs at the point of least resistance, whether at this point be situated a muscle, tendon, or fascia. This tear will take the direction of the course of the fibres composing the integral part at which the force is spent (Fig. 94); for the reason that it does not require so much force to split such a structure as it does to sever it at right angles. Should a tear occur along the course of the central tendon it may be denominated a *central tear*; if along the fibres of the transversus perinæi muscle or the transverse fibres of the triangular ligament, a *lateral tear*, with the prefix "right" or "left," as the case may be. The central rupture is regarded by most au-

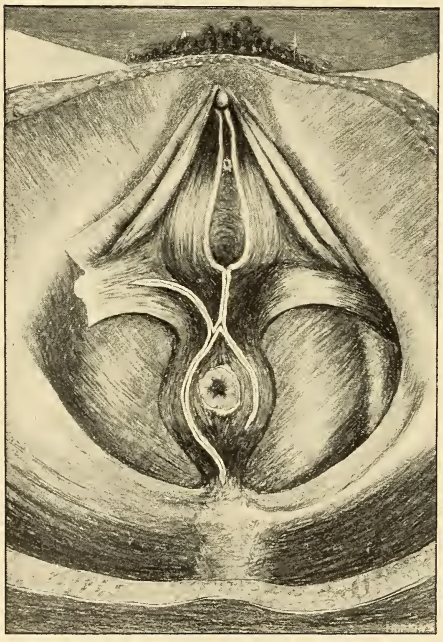

Fig. 94.—"This tear will take the direction of the course of the fibres composing the integral part at which the force is spent."—Dorsett.

thors as far the more frequent, but this is not the experience of Dorsett. Out of 1,006 ruptures of the perineum occurring at the St. Louis Female Hospital from July 15, 1887, to March 3, 1892, there were 296 central ruptures, 237 left lateral, 199 right lateral, and 10 ruptures of the third degree, or into the rectum, being more or less central. The remainder were of a superficial nature, or ruptures of the first degree. So great is the tendency for the line of tear to follow the fibres of the different tissues forming the perineum, that there are instances in which the tear, starting at the raphé, runs along the central tendon, here and there breaking a fibre and getting a little farther to one side until the sphincter ani is reached and penetrated; which muscle, on account of its peculiar circular form, may lead the tear around the anus, almost or completely enucleating the lower rectum from the surrounding structures, or it may pass on backward to the fibres of the coccygeal ligament and split them till it reaches a point at or near the tip of the coccyx. Two cases of enucleation of the lower rectum from these severe tears have been observed by Dorsett.

A laceration may start at the fourchette and take a straight backward course, following the raphé for a short distance, when, on account of a particularly strong fibre or set of fibres of the triangular ligament or transversus perinæi muscle, it may take a different course, producing a very irregular wound. Lacerations sometimes take a shape not unlike the letter L or an inverted Y or T.

When the head is in the first or second obstetrical position and there is not a great disproportion between the child's head and the maternal parts, and when the patient is tractable and can be controlled, the levator-ani muscle, as a rule, escapes injury. When an occiput posterior position is met with, the deeper perineal structures are apt to suffer, whether the delivery is instrumental or not. This is due to the fact that flexion can not take place and the occiput engages the posterior wall of the vagina and ploughs its way through the perineum, tearing the levator-ani and other deep muscles on its way outward. Occasionally, these posterior positions may cause what is known as perforating rupture. In other words, the perineum may be perforated by the child's head in such a way that the fourchette and sphincter ani may remain intact. Such injuries are, however, fortunately rare.

A most remarkable case of perforating rupture of the perineum is related by Liszt (*Monatsschrift für Geburtshülfe und Gynäkologie*). The subject was a primipara, aged twenty years, who had a normal pelvis and was in labour thirteen and a half hours. A swelling the size of a goose's egg appeared over the perineum and gradually increased in size until it ruptured two hours later. The child, which presented by the breech, was expelled through the opening, but the head had to be extracted. The fourchette and rectum were uninjured.

For the purpose of description, lacerations of the perineum may be described as degrees of injury, according to the extent of solution of continuity. As, for example, a laceration through the skin, mucous,

submucous, and subcutaneous cellular tissue, and as far as the muscle but not into it, may be termed a laceration of the *first degree*; if through the skin, mucous membrane, submucous and subcutaneous cellular tissue, and the muscular structures to, or into, the external sphincter-ani muscle, a laceration of the *second degree*; if through all the previously mentioned tissues, and also through the anal sphincter into the rectum, a laceration of the *third degree.*

Prophylaxis.—In the conduct of a case of labour it should be a matter of the utmost concern to the obstetrician to guard against a rupture of the perineum, the time for the most watchful attention being at the close of the second stage of labour; for, when the presenting part is pressing upon the perineum, the tenesmus becomes so great that the inclination to strain, as at stool, becomes almost irresistible. Still, in many instances, if the patient is directed to "breathe out" and to "take short breaths," she may control herself to such a degree that the head may, even in a primiparous woman, slip over the perineum without injuring it beyond a slight tear of the fourchette. Yet it must not be forgotten that the maintenance of flexion of the child's head is the desideratum, and it is the duty of the obstetrician, by constant manual effort, so to press the occiput downward toward the hollow of the sacrum, that, by the proper amount of moulding of the head, the occiput can come well up under the pubic arch. When this stage is reached, the force now to be exerted is in exactly the opposite direction —that of extension—and is exercised by placing the palm of the right hand, not upon the mother's perineum, as was taught by the older writers, but upon the part of the child's head that shows in the cleft of the vulva, till the parietal eminences are about to escape, when the left hand relieves the right, and the index and middle fingers of the right hand are carried into the rectum and hooked under the supra-orbital arches. Gentle traction is now made with the two fingers of the right hand upward toward the pubic arch, while the left hand holds the head well against the arch. As soon as there is shown to be some progress, the two fingers, already in the rectum, are carried farther upward, and the lower border of the superior maxillary bone (in the child's mouth) is reached, when traction is made upon it, and latterly the child's chin is substituted for the maxilla. During this process of "shelling out the child's head," very effective assistance can be rendered by the nurse or assistant, by the insinuation of the fingers between the child's occiput and the pubic arch, and by pushing down the upper vaginal commissure which engages the back of the child's neck, like a collar. This rule should be followed whether the forceps is used or not. In the great majority of instances the forceps is only necessary to bring down the head into the vulva and is then taken off; the remainder of the delivery can be accomplished in the manner indicated above. In the delivery of all cases, irrespective of presentation or position, traction, manual or instrumental, should be in the direction of the *axes* of the birth canal for the preservation of the perineum. This

rule should be strictly adhered to at the outset. Still, with the utmost care and good judgment, the perineum will be ruptured in a certain proportion of cases. J. W. Bullard (*Western Medical Review*, November 16, 1898), after having consulted Byford, Mundé, Martin, Hirst, Baldy, Coe, and Montgomery, as to proportion of lacerations during first labours, has found it to be about 30 per cent.

Consequences.—The immediate consequences of laceration of the perineum are according to the degree of injury sustained. If the laceration is of the first degree, the consequences are trivial. If of the second or third degree, the normal involution of the vagina and vulva is more or less interfered with, and the danger of sepsis greatly augmented. On account of the resulting torn and lacerated open wound, pathogenic organisms gain ready access. If the laceration extends into the rectum through the sphincter-ani muscle, the inability to retain the fæces and gas will render the patient a miserable sufferer.

The remote consequences, when the laceration is of the second or third degree, are many and not confined to the site of injury. For it must be remembered that the perineum is the support upon which rest the internal organs of generation as well as a part of the weight of the bladder; so that an impairment of this structure necessarily disqualifies these organs from performing their functions in a normal manner.

When the laceration extends to the anal sphincter and is deep enough to involve the levator ani, the transverse muscles, and the transverse fibres of the triangular ligament as well as the different layers of fascia, the anterior wall of the rectum and the posterior wall of the bladder are robbed of their natural support, and a sagging of these organs is the consequence. As soon as the solution of continuity takes place, the divided ends of muscles retract, and, in time, by the process of healing, will be covered by mucous membrane, which does not give strength but allows a pouching downward of these organs. Straining in the act of defecation or micturition augments the trouble, and, in the case of the bladder, a cystocele—in the case of the rectum, a rectocele—is formed. These abnormal pouches grow progressively larger and progressively give more and more trouble. In the case of the bladder, the loss of its posterior support, viz., the perineum, together with the tearing away of its natural moorings from their normal attachment around the internal aspect of the pubis by the passage of the child through the birth canal, leaves nothing to hold it up, and a sagging of the viscus is the result. This sagging down prevents the organ from emptying itself completely, and a decomposition of the residual urine soon sets up an often intractable cystitis.

A division of the structures composing the greater portion of the perineum, leaving only the sphincter-ani muscle, allows the rectum to pouch forward, thus forming the condition known as rectocele. This tumour is increased in size by the efforts at defecation, for the reason that the anterior wall of the rectum forms almost a right angle to the anus, and, at each attempt to defecate, this angle is increased, and

the pouch or sac is consequently likewise increased in size. On account of the inability to evacuate thoroughly the contents of the rectum, a constipation is inaugurated, which tends still further to increase the size of the tumour.

Not alone to the bladder and rectum, is the mischief done by a rupture of the perineum. The vagina, uterus, and uterine adnexa, also suffer. The lack of support given the vaginal walls causes them to drag the uterus downward, stretching its suspensory structures—viz., the broad ligaments on either side, the two utero-sacral ligaments posteriorly, and the two round ligaments anteriorly. Nature only intended these ligaments to act as " guy ropes," to poise the uterus in the pelvic cavity, and not as supports. The consequence is a giving way of these ligaments, resulting in either descensus or retro-deviations of the uterus and adnexa.

The restoration of the pelvic floor is demanded in all cases when the injury is sufficient to cause either destruction or serious deterioration of the functional power of this structure. When injuries are restricted to the external muscular layer (perineum) the impairment of function may consist, either in a mere enlargement of the vaginal outlet, with a consequent tendency to rectocele and cystocele, or, if the laceration has extended through the recto-vaginal septum, dividing the sphincter-ani muscle, the consequent loss of function finds expression in fæcal incontinence; the indication, therefore, is for the repair of what are ordinarily designated the perineal structures. If, on the other hand, the injury involves the internal muscular layer of the pelvic floor, the resulting impairment of function eventuates, not only in a tendency to rectocele and cystocele, but in general ptosis of the pelvic viscera; the manifest indication is, consequently, for a restoration of integrity and tone in the impaired deep muscles of the pelvic floor. When both layers of the pelvic floor are damaged, as is the case in probably the majority of instances, the resulting operation, to be curative, must comprehend a restoration of all the injured parts. It is needless to say that the necessary prelude to correct treatment must consist in careful examination and accurate diagnosis.

The immediate operation for external injuries of the pelvic floor, otherwise called lacerations of the perineum—i. e., the operation for restoration of the parts immediately after parturition—is one the expediency of which must be determined by the character of the laceration and the condition of the patient. If the laceration is not associated with much contusion, if the line of cleavage is direct and the surface smooth and of easy approximation, and if, moreover, the patient's condition is such as to admit of the operation, sutures may be applied at once and the wound closed. If, however, the laceration is of the eccentric variety, if the tissues are bruised and the proximal surfaces seem to be infiltrated with blood, and particularly if, in the presence of these conditions, the laceration is complete, attempt at immediate repair may be set down in the vast majority of cases as a mere

unnecessary and fruitless infliction of pain. The practitioner in justice alike to himself and his patient should, before attempting the immediate repair of these injuries, explain that the majority of such operations are failures. Union may be said to occur in less than 50 per cent of even favourable cases. When the practitioner deems the case in

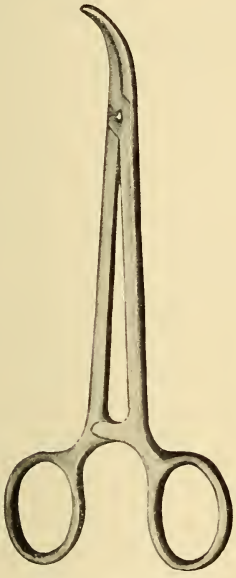

Fig. 95.—Hemostatic forceps.—Robb.

Fig. 96.—Scalpel.—Robb.

Fig. 97.—Emmet's left-angled, right-curved scissors.—Robb.

Instruments for Perineorrhaphy

Catheter, glass	1	Packer, vaginal	1
Forceps, hemostatic:		Retractor, small	1
Long	2	Intermediate	1
Intermediate	2	Scalpels (Fig. 96)	2
Small (Fig. 95)	2	Scissors, right-angled	1 pair.
Long dressing	1	Emmet's left-angled (Fig. 97)	1 "
Needles, as for abdominal sections (omitting the largest).		Straight-pointed	1 "
Needle-holders	2	Sound, uterine	1
Needle, Reed's curved	1	Tenaculum, straight	1
Nozzle, Edebohls's	1	Tenacula, curved	2

hand a proper one for immediate repair, he should recognise that every step of the operation should be done with the strictest antiseptic precautions. The patient should be put in position on the table and the vagina should be carefully irrigated, preferably with lysol or carbolic-acid solution; if the mercuric bichloride is used the solution should not be stronger than 1 to 4,000, because a stronger solution coming into

contact with the raw surfaces of the wound is liable to cause tissue changes that will interfere with the union. After cleansing the vagina, the upper part of that canal should be carefully packed with sterilized gauze, to prevent the escape of the lochia during the progress of the operation. After having again cleansed the wound, interrupted sutures of sterilized silkworm gut should be inserted, with careful observance of the principles governing their application, as set forth in the paragraph relating to the elective operation of perineorrhaphy.

Operations for Incomplete Laceration of the Perineum.—The *operation* for the repair of *superficial lacerations* of the perineum is very simple. A V-shaped area is denuded at the site of the former fourchette (Fig. 98), and is closed by interrupted sutures (Fig. 99), the resulting line of approximation representing the letter Y.

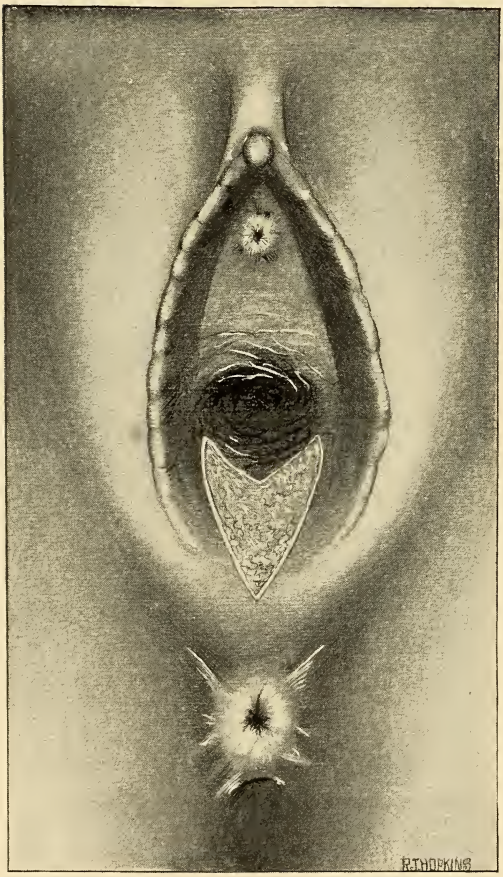

Fig. 98.—"A V-shaped area is denuded at the site of the former fourchette."—Reed.

Emmet's Operation.—The patient, after having been antiseptically prepared and anæsthetized, is placed upon her back, her buttocks at the edge of the table, her legs thoroughly flexed and intrusted to assistants, or preferably, to the mechanical appliances which constitute a part of the modern operating table (Fig. 100), the clothing worn during operations being omitted from the picture in order to show better the position of the legs. To hold the legs in a flexed position is both difficult for the assistant and not destitute of danger to the patient, for injuries have happened to the hip joint by injudicious pressure upon the flexed leg. Clover's crutch is not a desirable appliance for the reason that its mechanism is calculated to interfere with respiration and to become an embarrassment to anæsthesia. As soon as the patient is

put in this position and the labia are retracted, the posterior wall of the vagina will appear as a projecting mass within the vagina (rectocele, Fig. 86). A tenaculum is fixed in the middle and at the apex of this mass, which is now drawn forward and upward toward the pubes; as this is done the traction thereby induced will make apparent two folds, one on either side, leading from the point of the tenaculum to each lateral sulcus of the vagina. A tenaculum is then hooked into the caruncle caused by muscular retraction on either side of the vaginal outlet, and upon the tenacula thus placed lateral traction is made by assistants. A gutterlike fold is thus formed, the external end beginning at the caruncle and extending upward into the lateral sulcus where it coalesces with the fold from the central point of traction maintained by the tenaculum drawn upward toward the pubes, and another tenaculum is now placed at the site of the fourchette, midway between the two last named.

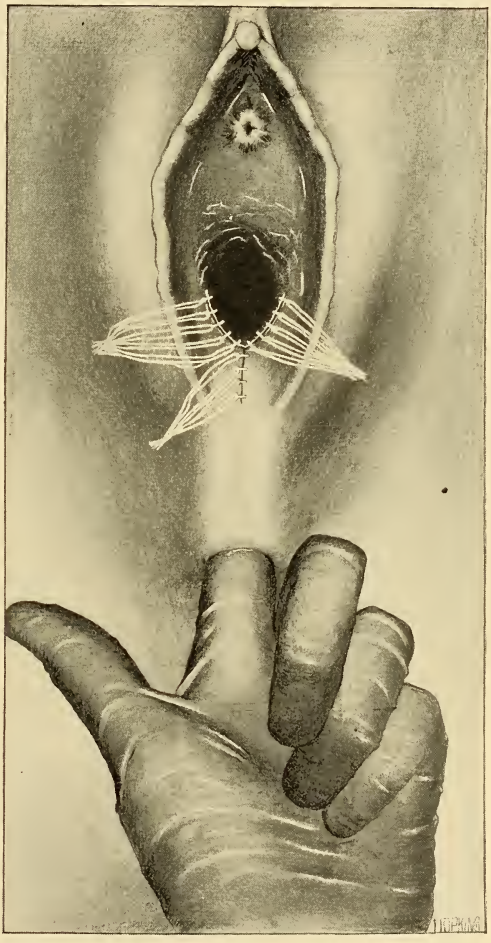

Fig. 99.—". . . Closed by interrupted sutures, the resulting line of approximation representing the letter Y."—Reed (page 260).

The traction made in this way indicates the area to be denuded, while the approximation of the two lateral tenacula and the one in the vaginal wall will show the final infolding and approximation of tissue that is to be accomplished by the operation. Again separating these three points, and re-establishing the upward and lateral tension, the operator can see, in clear outline, the area which is to be denuded. The margins of the folds induced by the traction are the indications for the incision, which is carried along the crest of one lateral fold to

the bottom of the sulcus on the same side, and from the bottom of that sulcus to the central tenaculum, on the posterior vaginal wall; it is then carried from this same central point to the bottom of the sulcus on the opposite site of the vagina, and along the crest of that lateral fold to the vulvar margin; the two ends of this really continuous incision are now united by carrying an intermediate incision from one lateral tenaculum directly across to the opposite lateral tenaculum. The territory thus outlined is next denuded, after which the median tenaculum on the posterior wall of the vagina is drawn down to a level with the lateral carunculæ. Sutures of silver wire are employed and are inserted first into one lateral triangle and next into the other lateral triangle of the wound. They are passed an eighth of an inch back of the margin, and traverse first the mucous membrane and then the underlying muscularis; are crossed over to the other margin of the same triangle and are passed out from below upward, including first the muscularis and then the mucosa. The sutures are inserted about one fourth of an inch apart and, in passing from one side to the other of the respective triangles, they are made to define a V-shaped course, the apex of the letter pointing downward (Fig. 101). This is accomplished by inserting the needle and bringing it downward to the median line of the triangular space, drawing it out, reinserting it at the point of exit, and directing it upward and inward. After the sutures have been placed in first one and then the other lateral triangle, the "crown suture" is inserted (Fig. 101). This suture is recognised by Emmet as the one of principal importance in the entire operation and is inserted at the point of the caruncular depression on one side, deeply enough to embrace within its sweep the levator-ani muscle. It is brought out on the denuded surfaces, passed over, and is inserted through the cellular tissue underlying the tip of the central mucous tongue. It is then crossed over to the other side, is inserted deeply enough to include within its sweep the levator-ani muscle, and is brought out just back of the caruncular depression of that side. A second suture an eighth of an inch from the foregoing may be similarly inserted if deemed expedient. Interrupted sutures are now passed from one side to the other, between the "crown suture" and the median perineal tenaculum, at intervals of about one fourth of an inch. The sutures are now tied, beginning with those at the apex of

Fig. 100.—"The patient is placed upon her back, her legs thoroughly flexed."—Reed (page 260).

first one and then the other triangle, the resulting approximated wound resembling the letter Y. Care should be taken in tying the sutures; for, if tied too tightly, they may induce necrosis from pressure. It may be taken as a safe rule that a suture is too tight whenever it blanches the tissues that it compresses.

The foregoing description is intended to convey a conception of the technique as employed by Emmet, and as yet practised by him and his numerous followers. Many of the latter, however, while following practically every other detail of Emmet's technique, substitute other suture material; McMurtry, for instance, closes the lateral triangles with formalinized catgut, using silkworm gut for the "crown sutures" and for the extravaginal sutures. From the fact, however, that formalinized catgut endures within the tissue from fourteen to twenty-one days—a longer period than the interrupted sutures are ever retained—the expediency of inserting buried "crown sutures" of this material is well worthy of consideration.

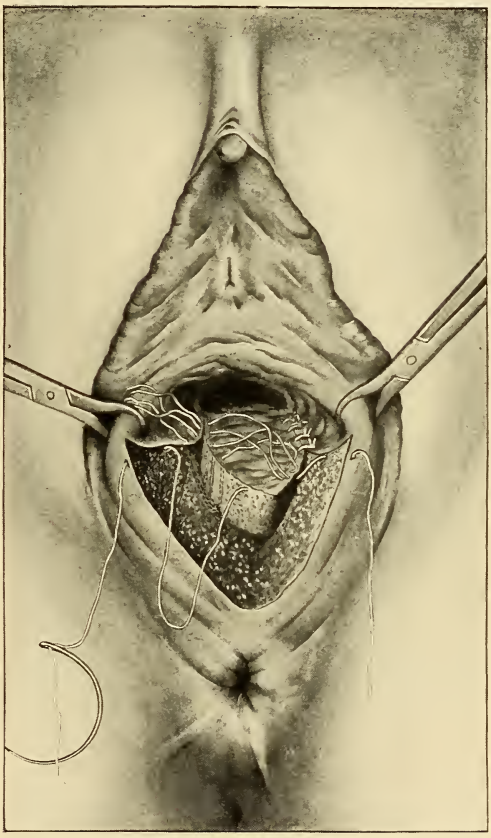

Fig. 101.—"After the sutures have been placed in first one and then the other lateral triangles, the crown suture is inserted."—Reed (page 262).

Reed's method of suturing is as follows: The denudation is made in the same way as in Emmet's operation—but the closure is effected entirely by means of the buried formalinized catgut suture. The crown suture is first inserted. A heavy curved needle armed with strong catgut is passed from left to right through the cellular layer of the mucous tip; it is then inserted a little to the right of the median line and carried deep enough to catch in its sweep the levator ani on the patient's left side. It is brought out beneath the cutaneous surface, and is carried to the opposite side and inserted beneath the cutaneous sur-

face, being made to embrace in its sweep the levator ani of the patient's right side (Fig. 103), when, being drawn taut, it will show the lines of approximation (Fig. 102). If the laceration is very deep and the separation is very pronounced, another crown suture of the same material is inserted in the same way; the ends of the crown suture, or of both of them if two are used, are left long and, for the present, untied. The wound is then closed by beginning on the inside near the apex of the left triangle, inserting the suture through the deep connective tissue and the muscularis, and bringing it out through the edge of the mucosa; it is then carried across and inserted through the edge of the mucosa, through the muscularis, and the deep connective tissue. The suture is now tied and the short distal end alone is cut away. This gives the suture its anchorage. (See Abdominal Section.) After this the needle is made to define the same circuit at intervals of one quarter of an inch, or less, until the lateral triangle is closed.

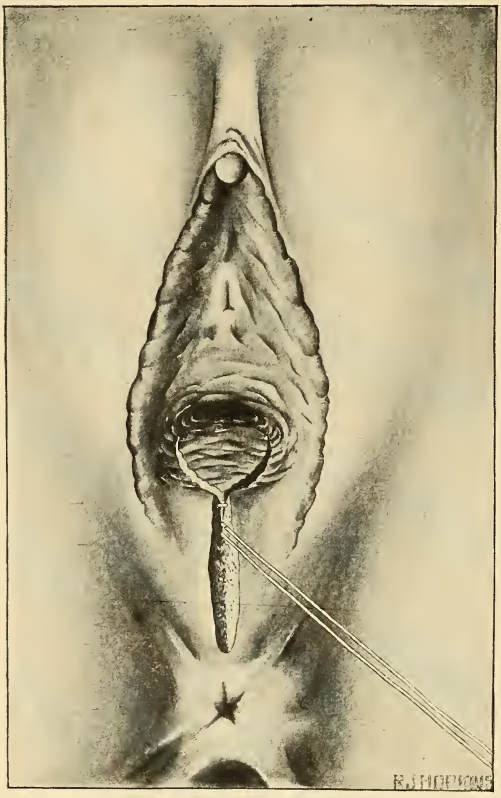

Fig. 102.—"Being drawn taut it will show the lines of approximation."—Reed.

The needle is then carried through the submucous connective tissue to the apex of the other triangle, when, without further preliminary fixation, it is made to approximate the margins of the wound as in the preceding triangle (Fig. 103). When both lateral triangles have thus been closed to the crotch of the Y, this suture is fixed by tying it in the deep cellular structures. The crown suture is now tied, the knot being on the inner surface of the approximated tissue. The remaining perineal wound is then closed by an intercutaneous suture (see Abdominal Section), forming the stem of the Y. In some cases it is well to fortify the approximation with a supplementary serpentine suture, passed subcutaneously (Fig. 109). The advantages of this method of closure are that it insures the best possible approximation of the parts; it gives the

patient less pain after operation; it is less liable to infection; and there is no occasion to remove sutures.

Various *modifications of Emmet's operation* have been made, many of them, unfortunately, ignoring its sound philosophic principles; others, however, while observing the principles of Emmet, differ from his operation chiefly in the manner of execution. One of the most valuable of these innovations is the procedure of A. Palmer Dudley, the essential point of which is to take a stitch which will draw up all the posterior mucous membrane at the middle of the posterior wall, so that none of it can interpose itself afterward when the parts containing the tendinous centre of the muscular floor of the pelvis are drawn into apposition. This eliminates the downward-projecting tongue of mucous membrane left by Emmet in his denudation. When a rectocele is present, the denudation is extended upward to the crest of the presenting pouch, forming a triangle the apex of which is in the median line of the posterior vaginal wall. The wound is closed by a series of interrupted catgut sutures, the ends of which are tied externally. In passing these sutures in cases not complicated with rectocele, the needle is inserted through the cutaneous margin and carried back coincidently with the long axis of the denudation for a distance of, perhaps, half an inch; it is then drawn through, reinserted at right angles, and brought out at the mucous margin, the buried portion of the suture making a letter L; the suture, next carried over to the opposite side at

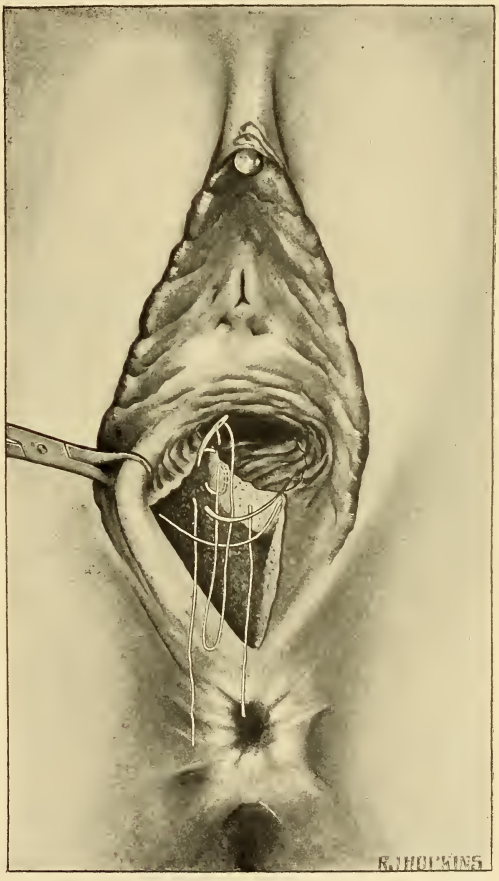

Fig. 103.—"The needle is carried through the submucous connective tissue to the end of the other triangle when . . . it is made to approximate the margins of the wound as in the preceding triangle."—Reed (page 264).

a corresponding point and inserted through the mucous margin at a distance of half an inch, is brought out in the midst of the tissue, and the needle reinserted at the point of exit and brought out through the cutaneous margin, the buried portion of the suture on this side making the letter L precisely as did the same suture on the other side. The second suture is passed in precisely the same way, the horizontal and perpendicular lines being parallel with those of the preceding stitch, from which it is distant about one fourth of an inch. Four or more such sutures are inserted and the ends are tied externally. In cases in which rectocele is present, the sutures are applied beginning at the apex of the upper triangle. The needle is inserted through the mucous membrane, pointing downward and inward toward the median line, at which point it is brought out; reinserted at the point of exit and passed through the tissues upward and outward, it is brought out through the mucous membrane on the opposite side of the triangle at a point directly opposite that of entrance. The buried portion of the suture thus introduced is in the shape of a letter V. Other sutures are applied in the same manner, the arms of the V gradually widening until, in the middle of the area of denuded tissue, the suture is directly horizontal, while those inserted below this point are parallel with it. The sutures are now tied, beginning with the upper intravaginal one, the wound when closed making a straight line along the raphé of the perineum, the fourchette, and the median line of the posterior vaginal wall. Lawson Tait adapted the flap-splitting operation to incomplete lacerations of the perineum, but with results less satisfactory than those following the Emmet operation, and vastly inferior to those which follow the adoption of the flap-splitting principle in cases of complete

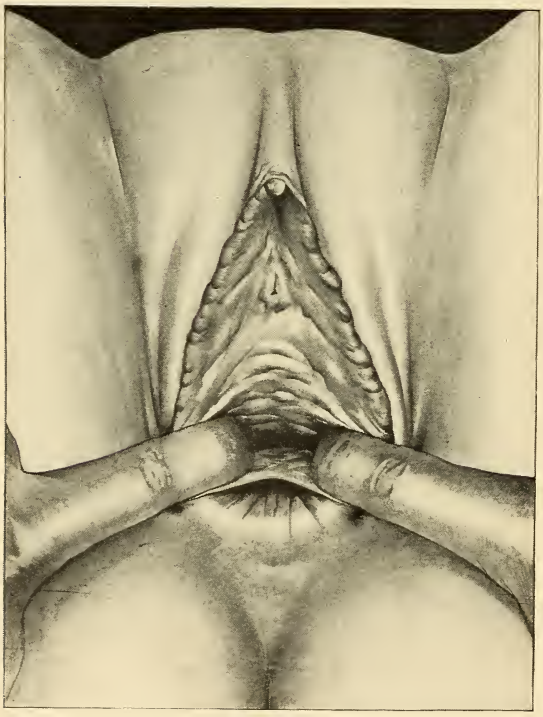

Fig. 104.—"The condition that is presented at examination." —Reed (page 267).

laceration. The Emmet operation may be accepted as a safe working method in incomplete tears of the perineum.

Operations for Complete Lacerations of the Perineum.—When the laceration of the perineum is complete, involving the separation of the recto-vaginal septum and a division of the sphincter-ani muscle, the resulting condition is much more embarrassing to the patient and much more difficult for the surgeon. In these cases there is a much more complete retraction of the perineal structures, a much wider gaping of the vaginal orifice, and an incontinence of the fæces. The condition that is presented at examination (Fig. 104) is that of a septum with only a narrow cicatrized margin which, if denuded by the ordinary trimming process, would afford but narrow surfaces for approximation. This, indeed, was a cause of failure in the majority of the older operations. To obviate this difficulty and to secure wider margin for approximation, Lawson Tait hit upon the expedient of splitting, rather than trimming, the septum. By this means, turning the rectal side of the flap into the rectum, and the vaginal side of the septum into the vagina, he secured, without the loss of tissue, approximating surfaces varying from half an inch to as much more as might be deemed desirable.

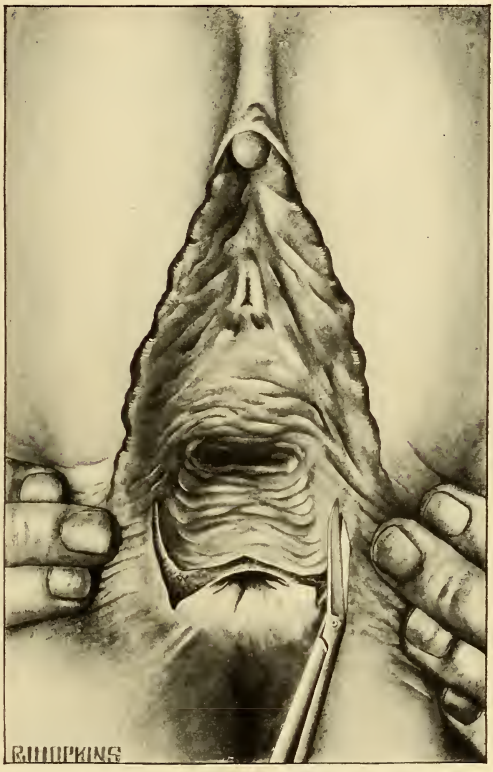

Fig. 105.—"The three incisions form the letter H."—Reed (page 268).

Lawson Tait's Operation.—The technique of the flap-splitting operation is as follows: The patient is carefully prepared with due antiseptic precautions and with careful attention to the condition of the bowels. This latter point is of extreme importance and should consume several days in its proper accomplishment. The bowels should be relaxed by repeated doses of salines given in small quantity and at frequent intervals. The Hunyadi or Apenta water or a mild solution of sulphate of magnesium may be given every few hours

until the bowels are relaxed, after which the saline should be kept up at longer intervals for the next couple of days. In the meantime the diet, while abundant, should be chiefly of the liquid variety. Catharsis should cease at least twenty-four hours before the operation. On the morning of the operation one or two high enemas should be given, washing out, not only the rectum, but the sigmoid and the colon. No opiates are given to restrain the bowels either before or after the operation. The vagina is now thoroughly sterilized and the patient is placed on the operating table. A bistoury or, preferably, a pair of keen-edged scissors curved on the edge or bent at an angle, may be employed to divide the septum. This is done by carrying the incision from one side to the other, between the vaginal and rectal layers of the septum, to the depth of about half an inch. The incision is next carried out to either side to the outer margin of the distinctly cicatricial area. Another incision is now made, beginning a little below, and a trifle to the outside of, the umbilicated point, indicating the location of one end of the retracted sphincter-ani muscle. The incision is carried upward along the outer margin of the cicatricial area to its upper angle. A similar incision is now made on the opposite side. The three incisions unite to form the letter H (Fig. 105). It will now be discovered that by bringing the two upright lines of the H into approximation with the median line there is a restoration of the original contour of the parts. In the act of bringing them together, the vaginal flap and the rectal

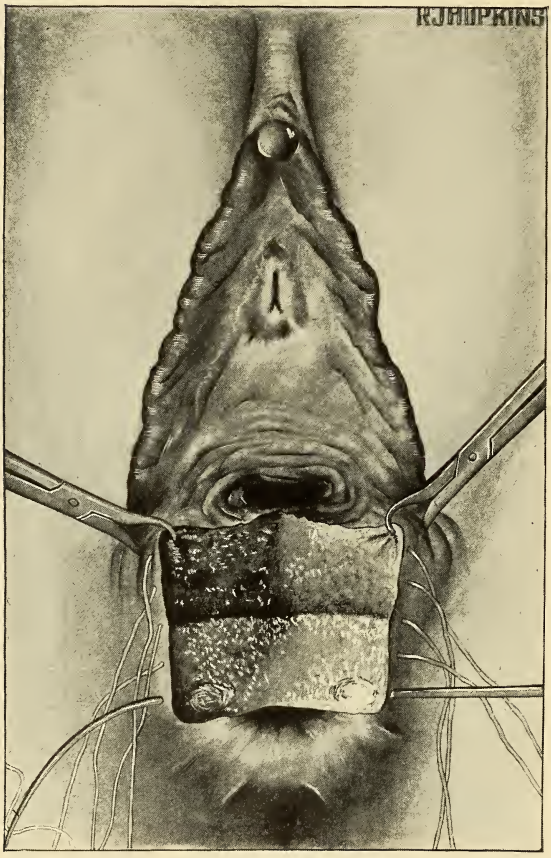

Fig 106.—"Other operators pass these sutures through the cutaneous margin."—Reed (page 269).

flap of the septum separate, approximating the broad proximal surfaces. Before the sutures are applied, a little more dissection may be required to expose the buried end of the retracted sphincter-ani muscle. This precaution is important. Tait was in the habit of closing this operation by passing sutures of silkworm gut by means of the Peaslee needle. Although other operators pass these sutures through the cutaneous margin (Fig. 106), the principle which he always observed in suturing was to apply these interrupted silkworm-gut sutures subcutaneously, the object being to draw forward and into approximation the retracted subcutaneous structures. The needle was inserted into the tissues beneath the skin, carried under the tissues to the opposite side, and brought out just beneath the cutaneous margin. Several of these sutures were thus passed and then tied. The result was a gaping margin from which protruded the free ends of the silkworm gut. Superficial sutures were next passed between the free ends of the deep tissue sutures, thus carefully approximating the external margins of the wound. It should have been stated that it was Tait's custom in passing the deep tissue sutures, always to make sure that he inserted one of them in such a position as to catch the retracted ends of the sphincter-ani muscle, which were then brought into apposition when the sutures were tied. The sutures were generally removed on the seventh or eighth day, rarely later than the tenth.

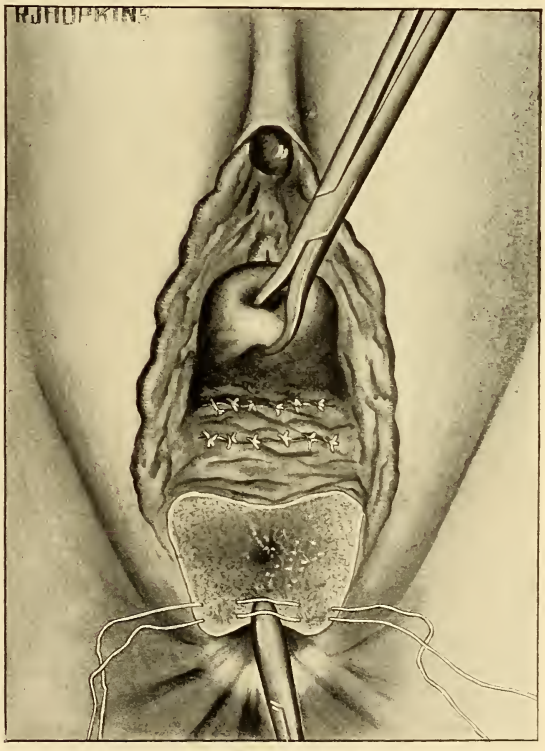

Fig. 107.—"The ends of the sphincter-ani muscle are transfixed by a suture of strong catgut."—Reed (page 270).

Modifications.—The principles of flap-splitting and of sphincter approximation first enunciated by Tait have been very generally adopted by the profession. These were the essential elements of his teaching. Many of his followers have changed the technique of closure by the em-

ployment of different suture material and by different methods of applying the sutures themselves. Reed during the last ten years has adopted the following method of applying the sutures in flap-splitting operations. The rectal flap of the septum is caught at its external corners by a volsella and approximated in the median line, its raw surfaces being brought together. These are now stitched together by means of a continuous catgut suture, beginning above and extending down to the anal margin, a step which, for clearness' sake, is designedly omitted from the illustration which shows this operation in connection with a completed operation for rectocele. The continuous suture is now fixed. The vaginal flap of the septum is next seized and sutured in a similar way. The previously isolated ends of the sphincter-ani muscle are transfixed by a suture of strong catgut (Fig. 107) and are tied in the median line and the suture cut short (Fig. 108). A second suture of this kind may be applied if deemed expedient. A few rows of continuous catgut suture are now passed from side to side, one layer upon another (Fig. 108), thus carefully approximating in an accurate tissue-to-tissue way the previously separated structures of the perineum. The operation is concluded by means of an intercutaneous suture, which may be fortified at the discretion of the operator with a buried serpentine suture of the same material (Fig. 109).

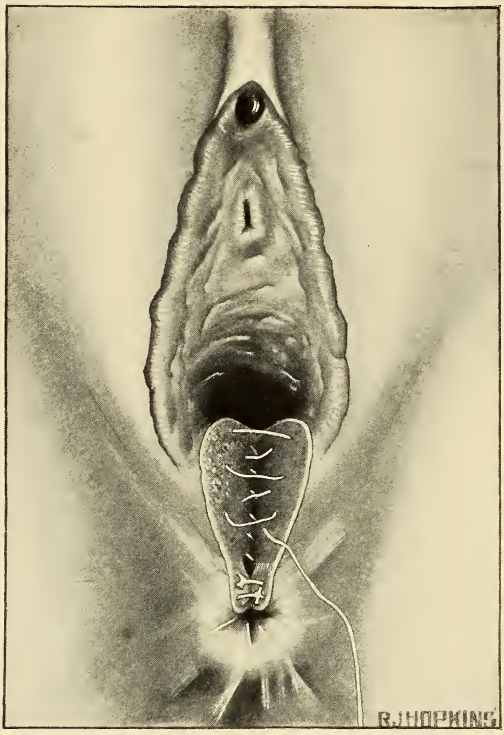

Fig. 108.—"A few rows of continuous catgut sutures are now passed from side to side."—Reed.

There are numerous other operations for the repair of complete laceration of the perineum, that have been devised by able surgeons, adopted by many operators, and have given satisfactory results. Of these the Simon-Hegar operation is one of the most important. It consists in denuding the cicatricial area freely, but, instead of leaving a central tongue of mucous membrane in the denuded area, a similar

tongue is removed upward along the dorsum of the vagina. The small triangular area thus made in the vaginal mucous membrane is first approximated by sutures, after which the remaining bat wings are brought together and sutured by their approximated mucous margins. The rectal mucous surfaces are then sutured together by means of interrupted sutures, the free ends of which are left in the rectum. A third row of sutures is finally applied to the cutaneous surface. The operations of Freund, Hildebrand, Heppner, A. Martin, and Le Fort, all contemplate denudation by cutting away the tissue, and closure by the use of interrupted, nonabsorbable, sutures. It is not apparent that any of them are more philosophical in conception, more easily done, or followed by better results, than is the flap-splitting operation of Tait. In conclusion, the practitioner may accept as a safe working method, the operation of Lawson Tait for complete laceration of the perineum, just as he may accept, as already advised, the operation of Emmet for incomplete laceration.

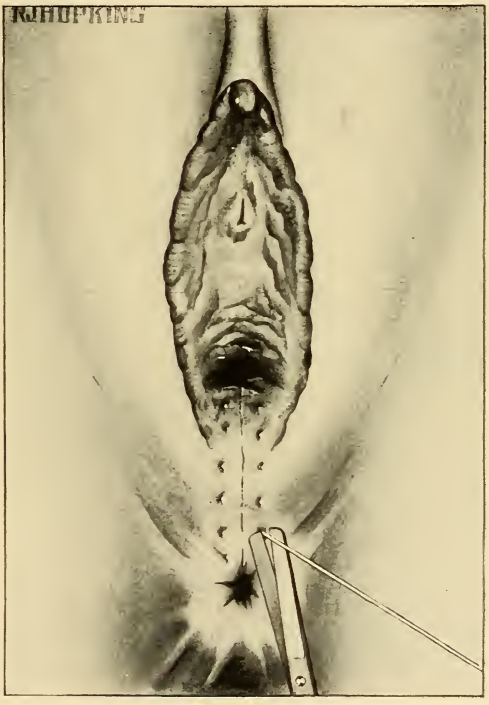

Fig. 109.—"The operation is concluded by means of an intercutaneous suture which may be fortified . . . with a buried serpentine suture."—Reed (page 270).

The repair of deep injuries of the pelvic floor has engaged the serious consideration of various operators. One of the principles most emphatically enunciated by Emmet was the necessity of reapproximating the separated median fibres of the levator-ani muscle. It would seem, however, that in the case of extensive injuries to this muscle the technique of the Emmet operation will not reach or control it, and the same may be said of those operations to which are attached the names of Freund and A. Martin. Goldspohn was the first to devise and carry into execution an operation calculated to restore the integrity of the deep muscles of the pelvic floor (*Medicine*, July, 1897). In connection with this operation he laid it down as an axiom that "direct union of the two lateral halves of the muscle and edges of the pelvic fascia beneath the vagina and

anterior to the rectum, should be the minimum requirement, no matter where the rupture showed itself superficially in the vagina." His operation consists of an adaptation of the advanced views of Schatz and the flap-splitting principle of Tait. It is done by dissecting up the lateral walls of the vagina, exposing the injured muscles, and restoring them, and the associated fasciæ, by buried animal sutures.

Harris's Operation.—Harris has perfected the technique of this operation which he describes (*Journal of the American Medical Association*) as follows: "When laceration of the perineum is present the denudation of this part is made in the usual manner. If this body be intact, the denudation is omitted. An incision is then carried up each lateral wall of the vagina from 3 to 5 centimetres. The edge of the muscle can now usually be felt and an incision parallel therewith is made through the perivaginal connective tissue, exposing the muscle (Fig. 110), which may easily be dissected out with the handle of a scalpel, blunt dissector, or the finger, ventrally as far as the symphysis, and dorsally until it curves round posterior to the rectum. Should the muscle have been so ruptured and its ends so retracted that its edge can not be distinctly felt, the incision is made along the line which the muscle should occupy, and careful dissection is made for separated ends. The ends of the muscle will be found connected by cicatricial tissue. I have yet failed to find the remains of the muscle even when badly torn and the ends widely separated.

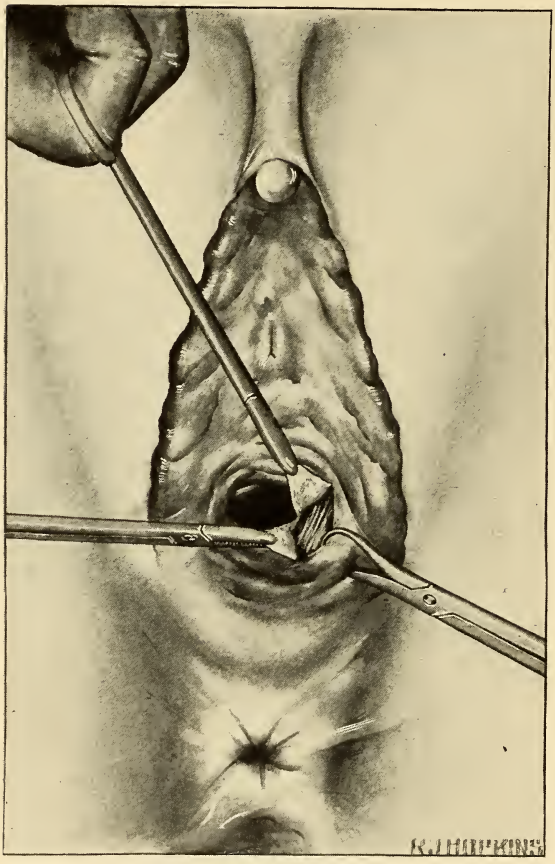

Fig. 110.—"The edge of the muscle can now usually be felt and an incision parallel therewith is made."—Reed.

"The muscle may vary considerably in thickness, and, when very thin and ribbonlike, it may be torn by a careless dissection. When multiple small lacerations are present, the muscle will not be entirely separated at any point, but will be lengthened, loose, and relaxed. In width or distance laterally, the muscle may be dissected from 3 to 5 centimetres. When it has been well freed, forceps should be placed on either side of the portion to be resected, so that the ends when cut shall not retract out of reach. The portion resected should correspond to the point of laceration if found, or when no distinct separation is found, to about the centre of the muscle. The extent of the piece resected will depend upon the amount of separation or the degree of lengthening and relaxation. It should be sufficient so that when the ends are drawn together the floor of the pelvis will be restored to its normal position and degree of tension. The ends of the muscle are then sutured together with an interrupted or continuous catgut stitch, which, of course, remains buried. The opposite side is treated in a similar manner when the incision of the lateral walls of the vagina is closed by a catgut suture. This latter suturing should be thoroughly done so that no openings will remain through which fluids or infection may reach the deeper parts. When the perineum has been torn this is closed in the usual way."

Hemorrhage in the course of this operation is sometimes free, never excessive and always controllable. It is, however, of extreme importance that all bleeding points be secured before the operation wound is closed, as a hematoma will prevent union by first intention, and, by a favouring infection, may defeat the objects of the operation.

The operation in the hands of Harris has proved entirely satisfactory. By its means he restores the normal floor of the pelvis in regard to both tone and integrity, carries the vaginal opening ventrad to its normal position, and restores its perineal flexure, while the muscles regain and retain their contractility and resume their elevating and sphincteric action at the vaginal orifice.

CHAPTER XXIII

MALFORMATIONS OF THE UTERUS

Classification: Embryonic, fœtal, postnatal—Absence—Uterus unicornis—Fœtal, infantile or pubescent—Uterus septus—Uterus bicornis—Uterus duplex—Minor malformations; atresia—Treatment; stomatoplasty.

The malformations of the uterus are very numerous and they are among the best known of all the structural anomalies to which the organs of the body are liable. Further, their mode of origin is in most instances fairly well understood, a fact largely explicable by our considerable knowledge of the embryology of the utero-vaginal canal. They have also a marked and practical bearing upon the phenomena of the reproductive life of the woman, gynecological no less than obstetrical.

Classification.—The most recent and most approved classification of the malformations of the uterus is founded directly upon the development of the organ (F. von Winckel, *Eintheilung der Bildungshemmungen der weiblichen Sexualorgane*, 1899). Uterine development may be divided into two periods, an antenatal and a postnatal; the former may again be subdivided into an embryonic and a fœtal period. The embryonic development of the organ takes place, roughly speaking, in the first three months of intrauterine life: it passes through three stages, in the first of which there exist the two Müllerian ducts as solid cords in the neighbourhood of the Wolffian ducts (first month); in the second, the ducts obtain their lumen and unite externally into one utero-vaginal tube (second month); and in the third, the ducts fuse internally into one hollow tube, the utero-vaginal canal, their upper parts, however, remaining distinct as the Fallopian tubes (third and fourth months). The fœtal development of the uterus occurs during the remaining five or six months of intrauterine life, and chiefly consists in the formation of the fundus of the organ, the transition from the *uterus planifundalis* into the *uterus foras arcuatus*, or fœtal uterus. Postnatal development takes place in two stages: in the first, corresponding to the first ten years of extra-uterine life, through the greater growth of the body as compared with that of the cervix, the *uterus fœtalis* becomes the *uterus infantilis*; and in the second, which may be said to extend from the tenth to the sixteenth year, the infantile uterus takes on the characters of

the adult but virgin organ. Now, the majority of uterine malformations are simply stages of development normally temporary but which have become permanent, and they may be divided into groups corresponding to the developmental stages which have been enumerated. These groups may be put in the form of a table.

Periods of life.	Groups.
Embryonic	I. (*a*) Absence of uterus, complete, together with absence of tubes and vagina (very rare).
	(*b*) One-horned uterus, with no trace of the other horn (*uterus unicornis sine ullo rudimento cornu alterius*).
	II. (*a*) Externally double uterus (*uterus duplex sine didelphys; uterus bicornis*).
	(*b*) Solid or partly excavated uterus (*uterus solidus, uterus rudimentarius, uterus partim excavatus*).
	(*c*) Combination of (*a*) and (*b*) (*uterus duplex solidus, uterus bicornis rudimentarius*).
	(*d*) One-horned uterus, with other horn solid or partly excavated (*uterus unicornis cum rudimento cornu alterius*).
	III. Uterus divided internally more or less completely, without or with external signs of duplicity (*uterus septus, subseptus, uterus bicornis septus*).
Fœtal	IV. Uterus with flat fundus, with or without complete or partial internal duplicity (*uterus planifundalis septus, subseptus, simplex*).
	V. Uterus with fœtal characters (small body, large cervix).
Postnatal	VI. Uterus with infantile characters (*uterus infantilis*).

There are some malformations which do not find a place in this scheme of classification. One of them, the trifid uterus or uterus accessorius, is specially difficult of embryonic explanation. To account for it we have to suppose the existence of a double Müllerian duct on one side; possibly it arises in the pre-embryonic or germinal period. Congenital prolapsus uteri also, which may be grouped with the malformations, does not represent a stage in the development of the organ so far as is known; since, however, it has always been found associated with spina bifida, it may be really rather a concomitant anomaly of spinal arrested development than an arrest in the evolution of the uterus. As to the cause of these arrests in uterine development there is still much darkness: inflammatory processes, e. g., fœtal peritonitis; defective formation of the abdominal walls, e. g., umbilical hernia; the presence of tumour germs preventing union of the Müllerian ducts, and traction upon these ducts exercised by neighbouring structures, have all been adduced as possible teratogenic factors; but they are all insufficient to explain the anomalies which have arisen in the embryonic period of intrauterine life. It will probably be found that uterine malformations, like malformations and monstrosities of other parts of the body, are due to the action of germs, toxines, and poisons, upon the tissues in the course of evolution (Pathology of the

Embryo.) (*Scottish Medical and Surgical Journal*, v, 481, 1899). It is unnecessary in a work such as this to describe in detail all the varieties and subvarieties of uterine malformation which the pathologist has differentiated; it will be sufficient if the leading types are dealt with in outline.

Absence or Rudimentary State of the Uterus.—Complete absence of the uterus, save in sympodial fœtuses and the acardiac twin monstrosity, is of excessive rarity; indeed, it is doubtful whether its occurrence in the adult woman has been established. On the other hand, it is far from uncommon to meet with patients in whom the organ is physiologically absent, or, to put it in other words, in whom there is a rudimentary uterus (*solidus, partim excavatus, membranaceus*). The tubes and vagina are usually also defective in such cases, but it is common to find a well-formed vulva and even a short vestibular vagina which has been made deeper by attempts at coitus. The symptoms vary with the presence or absence (or at least physiological absence) of the ovaries. There is always necessarily amenorrhœa; but when there are functionating ovaries menstrual molimina are met with, there are occasionally vicarious hemorrhages, and there may be a great deal of pelvic pain. Secondary sexual characters are generally present, but the vulvar hair may be defective. By means of a recto-abdominal bimanual examination (under an anæsthetic if necessary), and with the help of a sound in the bladder, it can usually be made out that the uterus is seriously defective. In the marked cases no thickness of tissue can be felt between the rectum behind and the bladder in front. It is doubtful in these instances whether any treatment of the nature of ferruginous tonics and the like should be adopted, for such will only prove ineffective and disappointing to the patient. When severe monthly suffering exists, the opening of the abdomen and the removal of the functionating ovaries must be considered; indeed, it is demanded in many instances, and can be done with not more than the ordinary risks of a cœliotomy. Vineberg (*Transactions of the American Gynecological Society*, xxiii, 396, 1898) has recently reported a case of this kind in which the removal of the ovaries was followed by the disappearance of symptoms; during the laparotomy it was noted that in addition to the ovaries there were two small oval bodies lying at the pelvic brim which were probably rudimentary uterine cornua.

Uterus Unicornis.—The absence of rudimentary development of one horn of the uterus produces the unicornate variety; when there is a rudimentary horn it may either be solid or show a cavity, and under the latter circumstances pregnancy or menstrual retention may occur in that cavity. The one-horned uterus has no proper fundus, for it inclines to one side and tapers to a point where it becomes continuous with the Fallopian tube (only one tube is usually present). Concomitant malformations are: small vagina, vagina septa, absence of one kidney and ureter, rudimentary condition of the ovaries. The uterus unicornis is not often diagnosticated during life unless it is dis-

covered during a laparotomy. Menstruation is not necessarily affected and pregnancy may occur in the single well-developed horn and pass to a normal termination; but when there is gestation in the rudimentary horn, then rupture of the sac commonly happens with results practically undistinguishable from those found after the bursting of a tubal pregnancy.

Fœtal and Infantile or Pubescent Uterus.—When the uterus in the adult woman instead of taking on its full development retains its fœtal or infantile characters, it is common to find along with it a poor mammary and vaginal development with symptoms of defective ovarian formation and sometimes such systemic disorders as chlorosis. There is either amenorrhœa or a scanty flow; sterility is met with; and there may be also dysmenorrhœa. The vaginal and bimanual examinations, together with the introduction of the sound, should enable a diagnosis to be formulated, and the relation of the size of the body of the organ to that of the cervix will distinguish the fœtal from the infantile type. The treatment will be directed toward establishing the growth of the uterus, and this is far from hopeless in the infantile form. Marriage has sometimes a good effect but should not be recommended unless the menstrual function has been established. In the unmarried, reliance must be placed upon the administration of iron, arsenic, and quinine, together with nourishing food and gymnastic exercises; in the married, electrical stimulation of the uterus or simply the periodical passing of the sound may be employed, but the insertion of a stem pessary as recommended by many is not free from risk and is of doubtful efficacy.

Uterus Septus.—The least marked form of double uterus is the septate variety in which the only indication of duplicity is found in the division of the interior more or less completely into two cavities (*uterus septus*, *subseptus*). Externally the uterus appears to be single but has sometimes a more markedly globular outline than is usual. The two cavities are commonly situated laterally, and there may or may not be indications of duplicity in the cervix. The clinical symptoms are indefinite: there may be amenorrhœa and dysmenorrhœa; or there may occur the curious twice monthly recurring hemorrhage which may be supposed to be menstruation from the two cavities of a non-synchronous type; and if one of these discharges is small in amount and accompanied by pain we have an explanation of one variety of the midpain or "*Mittelschmerz*." It is possible that a septate uterus may be a cause of habitual abortion, at any rate in one case the division of the uterine septum was followed by a normal pregnancy. During curettage the curette has been known to pass from one cavity of a septate uterus into the other, giving the sensation of perforation of the organ (Blondel, *Bulletins et mémoires de la Société obstétrique et gynécologique de Paris*, p. 53, 1898). The presence of the septum may complicate labour in this form of malformation; it may cause a malpresentation or a low implantation of the placenta, or to it the pla-

centa may be attached, in which case hemorrhage in the third stage is to be looked for. The diagnosis of this malformation has usually been made accidentally during the extraction of the placenta or in turning.

Uterus Bicornis.—In the bicornate uterus the upper part of the body shows distinct duplicity but the lower part and the cervix are single; on internal examination it may be found that the duplicity extends to the cervical canal also. The degree of separation of the two horns varies within wide limits, from a simple notch on the fundus to a wide interval. Further, the horns may be of the same or of different size, and in the interval between them may be seen a band stretching from rectum to bladder (recto-vesical ligament). The external genitals are generally normal but the vagina may show different degrees of duplicity (*vagina septa*, *subsepta*). One of the horns may be solid or partly imperforate, and in the latter case it may become the seat of a pregnancy or a menstrual blood accumulation (hematometra). The clinical history will be very similar to that met with in the septate variety. As regards menstruation, there may be a simultaneous discharge from both cavities each month, or a flow from one cavity one month and from the other the following month, or a discharge from each cavity each month but not at the same time (fortnightly variety). Pregnancy, apparently, not uncommonly happens in the bicornate uterus: during it, hemorrhage may go on from the unoccupied horn or a decidual membrane may form in it; both horns may contain impregnated ova, and the age of the gestation may not be the same in each, thus explaining some of the anomalous cases of superfœtation; and, rarely, a twin conception may occur in one horn. Labour may be interfered with in various ways: there may be a malpresentation; there may be delay from the presence of the recto-vesical band; there may be a low implantation of the afterbirth; and, as Halban (*Archiv für Gynäkologie*, lix, 188, 1899) has lately shown, in cases where the pregnant horn lies obliquely to the empty one the head of the infant may be driven during labour through the septum between the two cavities, and what was a left-sided fœtus may be expelled through the right cervical orifice. The diagnosis of the uterus bicornis, like that of the septate organ, is often not made till labour supervenes or till the abdomen is opened for some purpose; but if a double vagina or a double os uteri exists the anomaly may be suspected, and then a careful examination bimanually and with two uterine sounds may suffice to make it plain.

Uterus Duplex.—The most complete form of double uterus is the *uterus duplex*, *separatus* or *didelphys*; in it, the Müllerian ducts have failed to unite in that part of them which goes to form the body and cervix of the uterus, and commonly also in the vaginal part, so that there is at the same time a vagina septa. It is much rarer than the uterus bicornis and it is impossible to distinguish the one from the other with certainty during life. In a case reported by Ameiss

(*American Journal of Obstetrics*, xxxiii, 693, 1896) both uteri were somewhat retroverted; and in one put on record by Bernhard (*Centralblatt für Gynäkologie*, xxi, 1464, 1897) both were fœtal in development; in Ameiss's case there was pregnancy and in Bernhard's sterility.

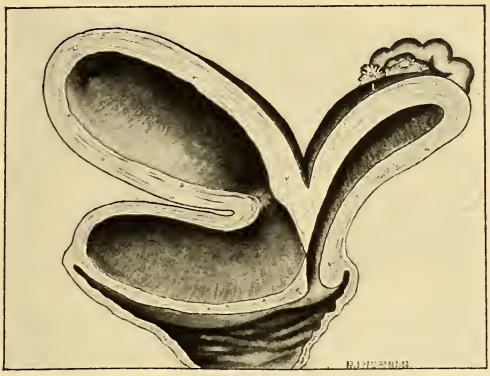

Fig. 111.—"A bicornate uterus with each horn well developed."—Reed (page 281).

Minor Malformations.—The uterus, in addition to the typical and marked malformations which have been already described, may be the subject of smaller anomalies, such as the want of rounding of the fundus (*uterus planifundalis*), *imperforation* of the cervical canal, or the presence of a *diaphragm* in it. *Congenital prolapsus uteri* has been recorded (Ballantyne and Thomson, *American Journal of Obstetrics*, xxxv, 161, 1897); curiously enough in all the reported instances it has been met with in infants suffering from lumbo-sacral spina bifida. In one sense pathologic anteflexion and retroflexion of the uterus may be regarded as malformations; but they are considered elsewhere. *Congenital elongation of the cervix* or *conical cervix* also occurs.

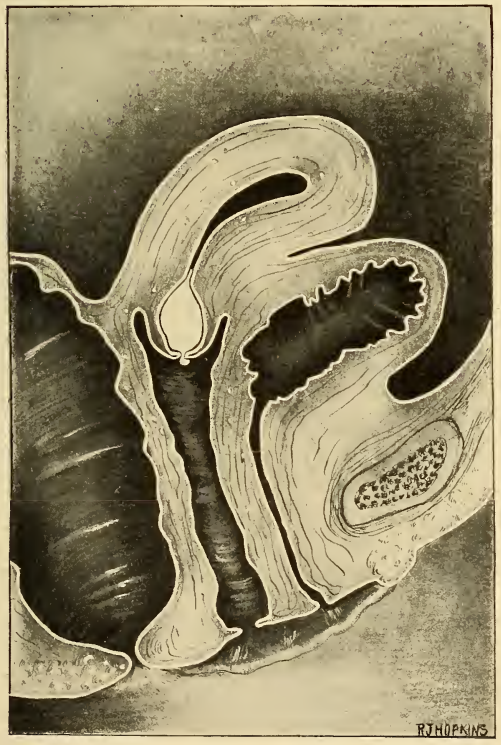

Fig. 112.—"This secretion . . . often accumulates to a degree that results in dilatation of the cervical canal."—Reed (page 282).

Atresia, or *complete occlusion of the cervical canal*, resulting in retention of the menstrual fluid, is sometimes encountered. Among the minor malformations of

the uterus may be mentioned *stenosis*, by which is meant a narrowing of the calibre of the canal, the constriction being situated as a rule either at the external os or the internal os, or, it may include the entire canal.

The treatment of malformations of the uterus must, of course, vary according to the condition. In those cases in which the uterus is absent or extremely rudimentary, but in which there develops a menstrual molimen, the patient may be seriously afflicted with ineffectual efforts at menstruation. Profound neurotic disturbances are liable to ensue. In these cases the only relief lies in extirpation of the rudimentary ovaries. In those cases in which the uterus is fœtal, infantile, or pubescent, the degree of development encountered will determine the remedial course to be employed. If the uterus is less than an inch and three quarters in longitudinal diameter, any effort to force its development by local means will probably prove unavailing; or, if development is provoked, there is but little hope that it can be carried beyond that degree which will result only in the most unsatisfactory establishment of the menstrual function. If, however, the uterus is an inch and three quarters or more in depth, intrauterine faradization may be employed with some prospect of success. Massage of the uterus is likewise an expedient calculated to promote its growth. But little, however, is to be promised in these cases. Patients or their friends may be assured that in certain instances the uterus has suddenly developed after having remained more or less rudimentary for years. These may be called instances of delayed development. A normal exercise of the menstrual function is never to be promised in these cases, nor is pregnancy to be held up as either possible or desirable. It is frequently to be noticed that girls with pubescent uteri and corresponding deficiency of the menstrual function show a tendency to obesity. These phenomena can only be accepted as exemplifications of the biologic law of antagonism between growth and genesis. The indication for treatment in these cases is to reduce the flesh and improve the quality of the blood which will generally be found to be deteriorated in some particular. When the flesh is reduced to the normal standard and the normal balance of the nutrient functions is thereby properly established, the uterus sometimes shows a disposition to develop without local treatment. The latter, however, is important and should not be omitted. The bicornate or septate uterus may be capable of exercising a menstrual function in either of its compartments. In occa-

Fig. 113.—"It is often necessary to remove a segment of tissue from either the anterior or posterior lip of the cervix."—Reed (page 283).

sional instances one cavity, and still more rarely both, is closed, with resulting hematometra. The condition may be undetected for some time, for the reason that the menstrual discharge may regularly appear from one side of the uterus, while it is retained in the other side. The latter condition, however, sooner or later develops pain which calls for intervention, when the real condition of the uterus is for the first time discovered. The appearance presented in the examination is sometimes bewildering in view of the fact that the gradual accumulation of fluid may have forced a comparatively thin and elastic septum downward through the external os, whence it protrudes in the form of a cyst. In these cases a mere excision of the wall will result in the collapse of the cystlike accumulation. Cullingworth has reported (*Transactions of the American Gynecological Society*) an interesting case which presented all the symptoms of a suppurating cyst outside the uterine cavity, with a fistulous communication between it and some part of the uterine canal. Exploration by abdominal incision revealed a bicornate uterus with each horn well developed, the right being larger, more globular in shape, and situated farther back in the pelvis, than the left. The two horns converged toward an isthmus and were continued in a common cervix. A retroperitoneal mass on the right of the cervix was found to be the origin of the discharge and was removed by vaginal section. It proved to be the expanded right half of the cervix (Fig. 111).

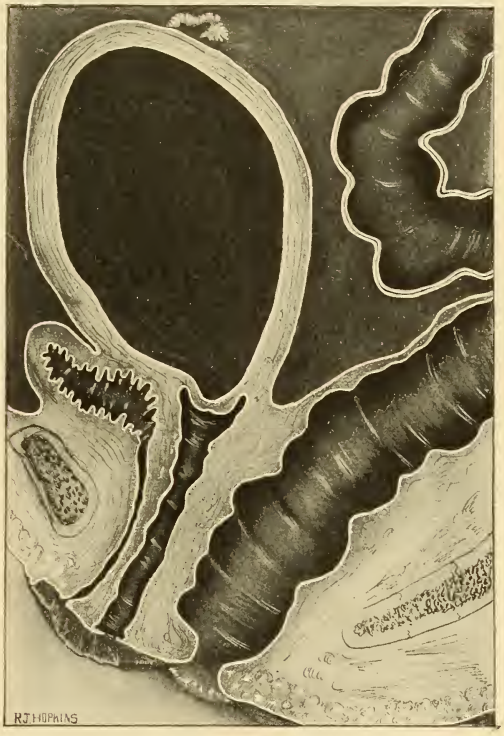

Fig. 114.—"Cases where there has been long distention with menstrual fluid."—Reed (page 283).

Stenosis may be relieved by an operation which Delagénière (*Chirurgie de l'utérus*) appropriately designates as **stomatoplasty**, which has for its object the permanent dilatation of the cervical orifice. Various expedients have been devised for this purpose. Courty before 1880 and Küster in 1885 promulgated the idea of discission of the neck

with reference to a permanent enlargement of the external os. Delagénière (*Chirurgie de l'utérus*, p. 328) has investigated the literature of the subject, and finds that the examples of Courty and Küster have been followed by Dudley, Nourse, Reed, and Pozzi; although the object aimed at by these different operators has been somewhat different. The procedure of Küster, like that of Dudley, was designed simply to enlarge the otherwise straight uterine canal which terminated in a contracted os; while the operations of Dudley and Reed were designed more especially to straighten the tortuous canal in cases of anteflexion.

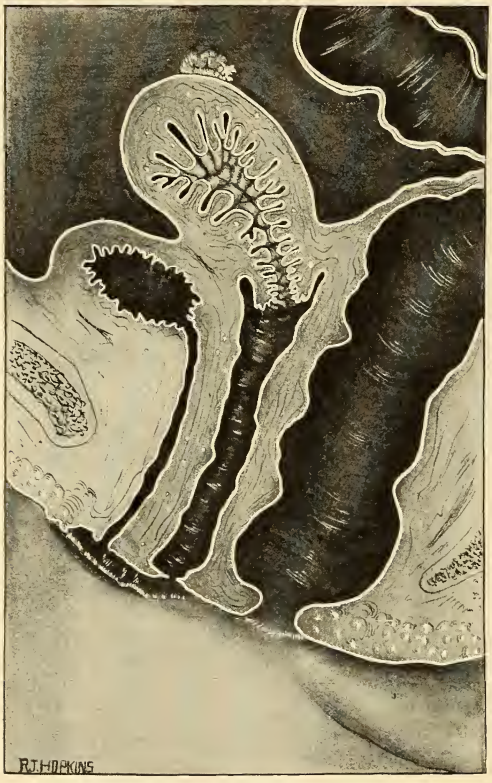

Fig. 115.—"There exists a redundant endometrium which may demand subsequent curettement."—Reed (page 283).

Enlargement of the external os is *indicated* in all cases of either occlusion or narrowing of that orifice. The same may be said of those cases of congenital atresia that are occasionally noted. In both cases the cause may arise from narrowing, either congenital, or due to a cicatricial deposit following the application of strong caustics or the excessive narrowing of the canal by trachelorrhaphy.

One of the first of these sequent conditions is the retention of the normal cervical secretion. This secretion, albuminous in character, often accumulates to a degree that results in dilatation of the cervical canal (Fig. 112). In this state the retained secretion forms a mucous plug which entirely occludes the lower end of the uterine tract. Such a condition persisting through months or even years results sooner or later in hypertrophy of that organ; not only is the uterus enlarged, but hypertrophic endometritis is developed. Dysmenorrhœa of the obstructive variety is an ordinary result. The endometrial changes may go to the point of fungous degeneration in which case menorrhagia and metrorrhagia are the consequences. In the absence of the foregoing indications, or, for that matter, in cases in which they are pres-

ent, sterility is the condition which brings the patient to the doctor's office. The obstruction to conception which is afforded, mechanically, not only by the narrowed orifice of the uterus, but by the constant plug of mucus within the cervical canal, are the conditions that demand removal.

The *operation* may be performed by different methods. In cases in which the os is of the pin-hole variety, very narrow and with a very considerable amount of retained cervical secretion above it, the cervical margins will be found to be little else than a film of tissue which is easily broken down by a dilator, or may be successfully broken up by means of a stellate incision. This is sometimes all the operation that is necessary; in the majority of cases, however, it will not be found to be sufficient. It is often necessary to remove a segment of tissue from either the anterior or posterior lip of the cervix (Fig. 113) and to bring the mucous membrane out, stitching its margin fast to the denuded margin of the other lip of the incision. If this is done anteriorly and posteriorly, a slight bilateral incision having been previously made, a very slight ectropion is produced. The results of the operation are very generally satisfactory. It should be remembered, however, that in cases where there has been long distention with menstrual fluid (Fig. 114) there exists a redundant endometrium (Fig. 115) which may demand subsequent curettement.

Congenital elongation of the cervix or *conical cervix* may be treated by forcible dilatation; if this is not satisfactory the cervix should be amputated. (See Amputation of Cervix.)

CHAPTER XXIV

DISPLACEMENTS OF THE UTERUS

Normal position of the uterus—Displacements in general: Varieties, causes, pathology, treatment — Retro-deviations: Symptoms and diagnosis — Treatment: Massage, electrolysis, tamponade, pessaries, surgical — Shortening the round ligaments—Alexander's operation—Mann's operation—Goffe's operation—Byford's operation—Vaginal fixation: The fundus, the cervix—Pryor's operation—Ventral fixation—direct, indirect—Anterior abdominal cuneo-hysterectomy — Ante-deviations: Symptoms, pathology, treatment — Dilatation and curetting—Dudley's operation—Prolapsus: Etiology, pathology, symptoms—Treatment: Conservative, surgical—Emmet's operation (anterior colporrhaphy) —Inversion: Symptoms, prognosis, pathology, treatment.

The normal position of the uterus can not be indicated by definite lines or specific limitations. By the nature of its construction and in consequence of its visceral relations, it has a considerable range of mobility. In infantile life its long axis presents but slight deviation from the long axis of the body, while its locus is on a line with the pelvic inlet. In mature life, however, the fundus leans forward to such a degree that the long axis of the uterus lies at right angles with the brim of the pelvis, the change of position amounting to about 45°. There occurs at this time a normal recession of the organ, until its fundus lies a little below a line drawn from the top of the symphysis pubis to the promontory of the sacrum. The distance from this line to the coccyx is about five inches, one half of which distance is occupied by the uterus in its long axis. While this definition of the position of the uterus is as nearly correct as can well be stated in words, the fact should be remembered that this organ vacillates both in actual location and relative position. A loaded rectum or sigmoid may force it forward, while, in the presence of an empty bowel and a distended bladder, the fundus of the uterus is lifted upward and backward. The uterus being swung in the pelvis by attachments upon either side, the focal points of which are situated laterally in the middle segment, it follows that when the fundus is moved in one direction, the cervix must move in the opposite direction. Aside from these movements the uterus has to a certain extent an up-and-down movement, rhythmical with the respiratory movements of the abdomino-thoracic diaphragm. It is this movement of the uterus, observable in almost any patient upon the examination table, that renders it more appropriate to designate as the pelvic diaphragm the structures in which the uterus

is embedded, rather than to apply that term to the deep muscular layer of the pelvic floor. These movements are normal, and any change of position within this normal range of activity should not be construed as a departure from the healthy standard. The arc of mobility may vary from 45° to 90°, while, with the rectum and bladder empty and with no undue voluntary pressure from above, the uterus will be found to return to a position approximating that already defined. A uterus may be said to be displaced when it ceases to manifest these normal variations of position, and when it persistently remains in a position distinctly at variance with the one which it should occupy under average conditions.

A proper comprehension of **uterine displacements** presupposes an understanding of the *anatomic connections and physical forces* by which the womb is retained in position in a state of health. It is important, at the outset, to look upon the uterus as a suspended rather than as a supported organ. The suspensory apparatus consists of (*a*) the peritoneal duplication called the broad ligaments, (*b*) the round ligaments, (*c*) the utero-sacral ligaments, (*d*) its attachments to the bladder and (*e*) to the structure comprising the floor of the cul-de-sac of Douglas, while (*f*) the cellular tissue at either side of the uterus is not to be ignored. The idea that the uterus is supported by a column from below was long ago demonstrated as fallacious by Emmet. A moment's reflection upon the infrauterine structures will convince the reader that they are neither constituted nor arranged to furnish support to the uterus; on the contrary, so far as they tend to exercise a modifying influence upon that organ at all it is to draw it farther down in the pelvis, rather than to maintain it at its normal level. It is to be recognised, however, that the vagina, the lower segment of the rectum, and the lower third of the bladder, are kept from exercising undue and overpowering traction upon the uterus and its suspensory apparatus by virtue of the supporting influence of the pelvic floor when in a state of integrity.

The *varieties* of uterine displacement may, in fact, be as numerous as are the variations from its average normal position. For convenience of study, however, these deviations are classified with reference to the abnormal movement of the fundus anteriorly, posteriorly, or laterally, and with reference to the movement of the entire organ either upward or downward. As a result, we shall have occasion to consider in the order of their frequency and relative importance (*a*) retro-deviations, (*b*) ante-deviations, (*c*) prolapsus, (*d*) lateral deviations, and (*e*) inversion. The ante- and the retro-deviations are further divided into versions and flexions. A uterus is said to be in a condition of version when its longitudinal axis deviates from its normal plane; while flexion of the uterus consists in the bending of the organ upon itself.

The *causes* of uterine displacements are numerous, and are to be considered in their relation to abnormal deviations in general, rather than with reference to the operation of a particular cause in producing

a particular displacement. Thus, constipation, by inducing pressure upon the uterus through the direct influence of either a loaded rectum or sigmoid, or by the pressure of the enteroptosis that constipation sometimes causes, forces the uterus downward in the pelvis. Whether the pressure thus exercised exaggerates the pre-existing normal anteversion, or whether it forces the uterus backward into a distinct retrodeviation, depends upon the incidence of co-operative forces. This is illustrated by the downward pressure exercised as above indicated at the same time that the uterus is forced backward by a distended bladder, a combination of influences calculated to produce retro-deviation; or the same condition may be induced by having the uterus lifted up by means of a distended bladder when the patient receives a sudden fall or jumps from a vehicle, landing upon her heels, thus forcing the fundus suddenly below the promontory and into the excavation of the pelvis. Child-bearing is, perhaps, the most fruitful single cause of uterine displacements. In the parturient act, the uterus is subjected to violent influences which may damage its suspensory apparatus. If the lying-in woman gets up before the womb has had time to shrink, or if she engages in laborious occupation while it is yet heavy, she is very liable to have some form of uterine displacement as a result. In many cases, even after the lapse of considerable time, a remaining subinvolution makes the uterus so heavy that it is thereby forced out of its normal poise. Occupation, particularly those employments that involve the lifting or carrying of heavy burdens, or that necessitate overhead work or much stair-climbing (see General Etiology), tend to force the womb out of position. Malpositions of the uterus are very common among young women employed in shops and factories, where long hours of standing are necessary. Pelvic inflammations, particularly cases of metritis of puerperal origin and of Fallopian tube infection, resulting in pelvic exudations and consequent adhesions, are a fruitful source of displacements.

The *pathology* of uterine displacements has been foreshadowed to a certain extent in the etiology. The changes that ensue on the first departure of a permanent character from the normal poise of the uterus are various; thus, in the case of a retro-deviation the fundus drops backward into the cul-de-sac, in a position of either *version* or *flexion*. In either of them, in the presence of more or less acute inflammation of the pelvic peritoneum, adhesion is likely to occur. The altered position of the uterus with the consequent interference with the circulation, particularly on the venous side, results in a mechanical engorgement of the organ. The turgescence results in enlargement, increased weight with more or less œdema, and, in some cases of long standing, hyperplasia. Corresponding hematogenous changes are also manifested in the endometrium, which, at the menstrual epoch, is liable to become hemorrhagic, with a constant tendency to more or less metrorrhagia. When the displacement is associated with flexion interesting changes take place at the point at which the organ is bent. On its

under, or concave, surface, there occurs an amount of pressure, varying according to the degree of angulation, upon the bent and approximated surfaces, that sooner or later induces atrophy of the posterior uterine wall at that point. While these changes are occurring on the concave side of the uterus, opposite changes are noticeable on the upper or convex side, where the tissues, instead of being subjected to abnormal pressure, are in a state of unnatural tension. The anterior, or upper, wall, yielding to this tension, presently manifests appearances of compensatory hyperplastic development; the result is a thinned, relatively attenuated, uterine wall on the one (concave) side, as opposed to the elongated and redundant wall on the other (convex) side. These are the cases that are persistent even in the absence of adhesions. In other cases, however, particularly those in which the displacement has followed upon a puerperal metritis, there seems to have occurred more or less fatty degeneration, with consequent loss of tone of the uterine parenchyma and resulting abnormal flexibility of the uterus, particularly at the cervico-corporeal juncture. In these cases the uterus may be found in a state of anteflexion one day, while the next day the surgeon will find the fundus in the cul-de-sac. Coincidently with these changes, others equally marked occur in the uterine ligaments. In many cases associated with intrapelvic infections it may be accepted as true, that the loss of tone due to inflammatory disturbances in the ligaments themselves constitutes the initial change in the development of uterine displacements; but, whether causal or sequent, relaxation with elongation of the ligaments sooner or later occurs. The utero-sacral ligaments, normally taut, become distinctly relaxed, permitting the cervix to go forward, while the round ligaments become stretched and permit the fundus to drop backward; or, the broad ligaments, the seat of an infiltration, cease to exercise control over the poise of the uterus. While these changes, essentially inflammatory in character, permit abnormal mobility of the uterus, it is to be remembered that sooner or later occur, in structures containing considerable connective-tissue elements, those contractions which ensue upon the absorption of inflammatory products. The essentially atrophic changes in this stage of the inflammatory process result in contractions more or less marked in all the involved structures except the round ligaments, and productive of more or less distortion of the uterus. If it were imaginable that these changes would occur coincidently and equally in all the suspensory structures of the uterus, it could be understood that that organ would thereby be drawn back to its normal position and so retained more firmly than before. Unfortunately for such a result, however, the round ligaments do not partake of the contractile changes, while adhesions generally take place by which the fundus becomes anchored in the cul-de-sac, to the wall of the bladder, or to a proximal surface of intestine; or, as too frequently happens, the exudation is so extensive as to involve, not only the uterus and the approximated peritoneal surfaces, but also the Fallopian tubes and the ovaries, in the general agglu-

tination. Under these circumstances, the resulting inflammatory contraction of any or all of the uterine ligaments can not do otherwise than develop counter traction, causing thereby an intensification of the general intrapelvic distress. Occasionally, the inflammatory process with the resulting adhesion occurs on but one side of the pelvis, or, if it occurs on both sides, one side undergoes resolution while the other side shows the mischievous results of exudation, adhesion and lateral displacement.

The pathology of *prolapsus* of the uterus differs materially from that in which there exists a mere deviation from the normal axis without descent of the organ below its normal plane. It is indeed an open question whether prolapsus of the uterus should be pathologically classified merely as uterine displacement; for, as a matter of fact, the descent of the uterus in the pelvis is but little more than an incident in a series of broader and more comprehensive morbid changes. It is doubtful whether descensus uteri should be considered otherwise than as a feature of a general intrapelvic hernia. The pathology of this condition involves very generally an enteroptosis, a weakening of the suspensory apparatus of the uterus, and a relaxation of the pelvic diaphragm proper, with either a laceration or relaxation of the pelvic floor. The frequent occurrence of descensus uteri in women who have never borne children or who have never sustained sexual relations, indicates that this form of hernia frequently occurs independently of puerperal conditions. It may be held as true, however, that in the majority of cases, the impairment of all the structures involved in this condition is due to the accidents of childbirth. The exercise of undue force, involuntary, manipulative, or instrumental, may have done serious damage to the suspensory apparatus; or the undue distention of the cervix, resulting in its laceration or in the laceration of the circumuterine or perimetric fascia, or in damage to the floor of the pelvis (see Injuries of the Floor of the Pelvis), may have laid the foundation for this form of visceral extrusion. Injuries to the floor of the pelvis alone, if permitted to persist, may induce within the pelvis changes that will permit the descent of its contents. This occurs, not from the removal of any fancied support to the uterus, but from the widening of the vaginal outlet permitting the vaginal walls, the rectum, and the bladder, to descend and to exercise undue, and finally overpowering, traction upon the uterus and its normal attachments. It thus happens that injuries to the pelvic floor may be the primary and causal condition, while the reverse may be equally true.

The Treatment of Uterine Displacements.—The idea that uterine displacements in themselves cause little or no harm is held now by very few gynecologists. The multitude of methods which have been devised for curing these displacements is proof that the vast majority of surgeons see in them something which needs correction. Mann takes it for granted that uterine displacements in themselves have an important pathological bearing; that a woman with a displaced uterus can never be perfectly well, and that the malposition should, there-

fore, be corrected. This may be done in various ways. Unquestionably a certain proportion of downward and retro-deviations may be relieved by mechanical devices—pessaries of various kinds. But these, at best, are rarely curative, giving relief only while they are worn. To make a permanent cure, some surgical procedure is necessary, by which the natural supports of the uterus may be returned to their normal condition, or else some new support may be added, whereby the uterus shall be prevented from getting out of place. If there is any exception to what has been said, it is in regard to forward displacements. The tendency to their surgical treatment has diminished with time, and now very few operate for anteversion or anteflexion, except by dilatation and curetting. Still, there are cases where some other surgical operations seem to be demanded, and these will be considered. Prolapse has been, and still is, a battle-ground as to the proper method of gaining permanent relief.

It is the firm belief of Mann that more good can be done, with less risk, in the surgical treatment of uterine displacements than in any other branch of gynecological surgery. The mortality of these operations in themselves should be *nil*. Of course accidents may happen and an occasional death occur; but usually they may be considered as being in themselves without danger to life. The dangers, if any, must arise from the serious complications which are often coexistent with the displacement.

Retro-deviations of the uterus are of frequent occurrence. The combined observations of Winckel, Lohlein, and Sänger, embracing several thousand patients, show that retro-deviations occur in 17.74 per cent of all gynecologic patients. These displacements may cause no appreciable symptoms; or, on the other hand, they may create such disturbance that they may properly be classified among the most distressing and persistent maladies with which a woman can be afflicted. They give rise not only to local discomfort but to constitutional ill health; they render a woman unfit for the marital relation and are the cause of sterility; and their prompt detection and effective treatment are among the most imperative duties devolving upon the practitioner.

Symptoms and Diagnosis.—When retro-deviation occurs suddenly, as from a fall or a jump, the patient complains of pain low down in the back, sacralgia, and general pelvic discomfort. This discomfort may at times become a sharp lancinating pain. When the displacement is of longer standing, the patient complains of pain in the back and in the neighbourhood of the sacrum and the coccyx, often radiating down the legs, frequently into the external pudendal organs and often centring in the clitoris. This pain is exaggerated by walking, stair-climbing, or any laborious occupation. Dysuria is generally present, and the patient sooner or later complains of constipation. This latter condition is frequently associated with other disturbances of the digestive tract, causing impairment of the general nutrition, loss of flesh, and the general appearances of anæmia. The diagnosis, however, will

depend upon the physical conditions discovered by local examination. The examination should be made with the patient on her back and her head a little elevated (Fig. 116). Digital examination, particularly in the case of retroversion, will reveal a change in the uterine axis, manifested by anterior displacement of the cervix. If the finger is now passed up toward the cul-de-sac, a mass will be felt. This may be due to a loaded sigmoid, a subperitoneal myoma, an enlarged and displaced ovary, or a descended and distended Fallopian tube; or it may be the fundus of the uterus. At this point, the diagnosis will be materially facilitated by placing the other hand over the abdominal wall, when, if the condition is a retro-deviation, the fundus of the uterus will not be discovered in its normal situation. If the case is one of retroflexion instead of retroversion, the point of angulation can generally be discovered by the tip of the intravaginal finger. In recent cases of uncomplicated retro-deviation, pelvic engorgement associated with pronounced tenderness may be present, and may temporarily mask the condition of the uterus. Retro-deviations frequently exist as complications of myomata, and of inflammations, enlargements, and displacements, of the appendages. The sound was formerly employed as a means of diagnosis in these cases, but so much damage has followed its use that its employment in this connection has been abandoned by judicious practitioners. An index finger may be introduced into the rectum whereby some additional information may be obtained. The diagnosis should, however, be made by means of the bimanual examination and without recourse to instrumental or other exploration.

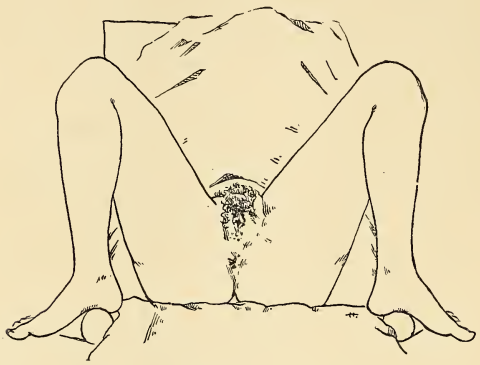

Fig. 116.—"The examination should be made with the patient on her back and her head a little elevated."—Reed.

The treatment of retro-deviations consists in the application of topical, mechanical, and surgical, measures. The first step in the judicious application of any of these means of cure must consist in determining, with, at least, approximate accuracy, not only the existence of the displacement, but of the various complications with which it may be associated. Thus, in the presence of a metritis, of acute inflammation of the Fallopian tubes, or of recent intense and painful general engorgement of the pelvis, all manipulations having for their object the reduction of the displacement should be interdicted. In the presence of these conditions, the patient should be put in the recumbent posture and should be treated with salines, hot douches,

and glycerine tamponade, until the acute symptoms have subsided. When there are no contraindications reposition of the displaced organ should be undertaken. The patient should be placed in Sims's position (see Gynecological Examinations), or she may be placed in the knee-elbow posture (Fig. 117). With the index finger passed toward the cul-de-sac and pressing against the fundus, that portion of the uterus in the absence of adhesions may be readily thrown forward. The manipulation is sometimes assisted by pressure directed toward the cervix, the hand being placed above the pubes for this purpose. The index finger passed into the rectum will enable the operator to manipulate the fundus of the uterus with more force and precision. The various so-called uterine repositors are to be looked upon as expedients of more than doubtful safety. The old practice of introducing a curved uterine sound and of then turning it round in the uterine cavity thus forcing the uterus back into position, has been denounced by intelligent gynecologists and abandoned by conscientious practitioners. The practical impossibility of introducing a uterine sound without making it the bearer of pathogenic germs, and the extreme probability of establishing an infection atrium by its use, indicate a danger the reality of which has been confirmed by more deaths than have been honestly recorded.

Fig. 117.—"She may be placed in the knee-elbow posture."—Reed.

Massage has been employed in the treatment of these cases. This consists in a series of intrapelvic manipulations effected by means of bimanual operation, whereby the uterus is subjected to pressure and the contracted ligaments and adhesions undergo tension. (See Massage.) It goes without saying that this method of treatment is contraindicated in the presence of infectious conditions of the uterine adnexa and of the pelvic lymphatics. The extreme difficulty of detecting these conditions renders massage a dangerous remedy, a fact which is confirmed by its general abandonment by the profession. *Electrolysis*, as employed in these cases, consists in the application of strong currents of electricity, for the purpose of causing the absorption of plastic deposits and of the utero-peritoneal adhesions associated with retro-deviations. Its method of application implies the repeated introduction of an electrode into the uterus, a fact which, of itself, renders it undesirable as a systematic treatment. *Tamponade* is an expedient of great value in the treatment of these cases. If the tampon is carefully applied and is of the proper material, it will furnish to the displaced

uterus an important mechanical support, while, if saturated with glycerine, the exosmotic property of the latter will exercise a valuable influence in effecting the absorption of inflammatory exudates. A tampon, however, which amounts to nothing more or less than a large plug in the vagina (Fig. 118), and which is large enough to distend the vulvar orifice when it is removed and requires considerable traction to remove it, is always a source of damage. The repeated downward traction thus exercised upon the vaginal wall has a tendency to drag the uterus downward in the pelvis and thus to aggravate the very condition that it is designed to remedy. A tampon properly adjusted should occupy the upper portion of the vagina, should not exercise enough pressure to occasion discomfort, and should be so constructed that its removal will not involve traction upon the pelvic viscera. The well-known chain tampon (Fig. 119) is very good; but a better one consists of a long narrow roll of either lamb's wool or cotton, with the fibre running lengthwise, and with a string attached at one end (Fig. 120). The ends of the string are left about 6 inches long. A strand of silkworm gut used for this purpose is very desirable because of its lack of porosity. The tampon, 10 or 12 inches long, or even longer, is now passed into the vagina through a speculum, care being taken that it does not

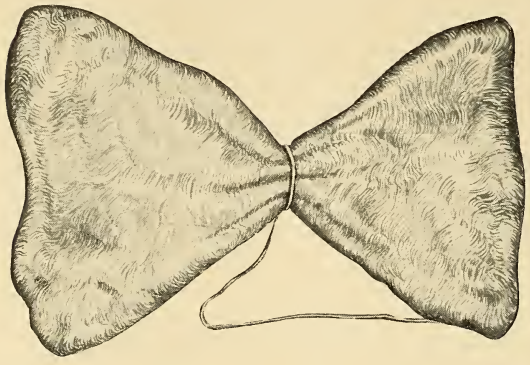

Fig. 118.—"A tampon which amounts to nothing more or less than a large plug on the vagina."—Reed.

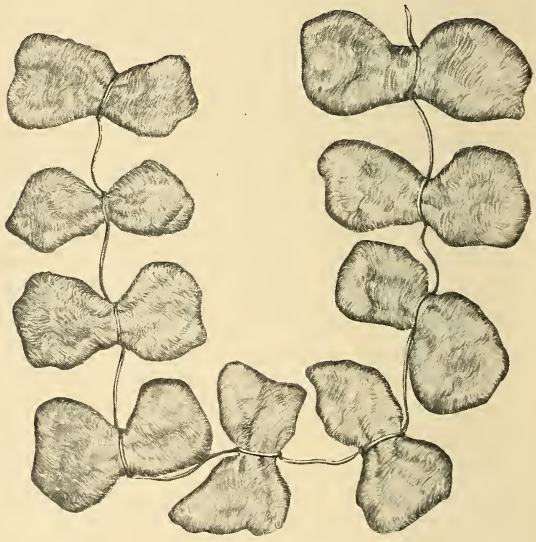

Fig. 119.—"The well-known chain tampon is very good."—Reed.

extend far enough down in the canal to occasion tenesmus. When such a tampon is removed, but little effort is required, and the patient makes no complaint of the dragging and pulling that is the unpleasant feature in the removal of one that is improperly constructed. (See Nonsurgical Treatment of Salpingitis.)

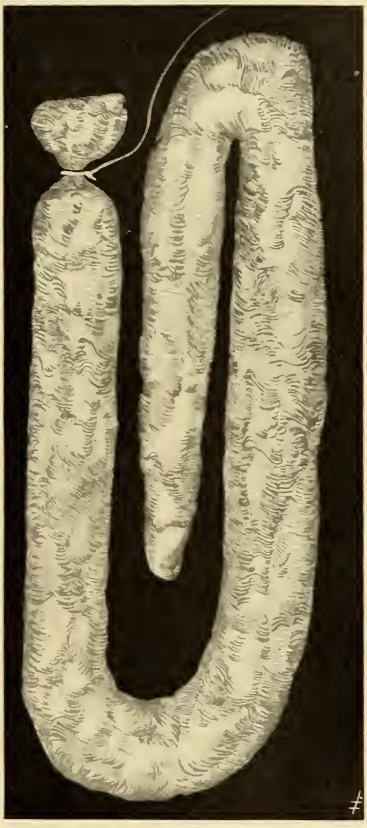

Fig. 120.—"A better tampon consists of a long narrow roll of either lamb's wool or cotton, with the fibre running lengthwise, and with a string attached at one end."—Reed (page 292.)

Pessaries have long been employed as a means of retaining the replaced uterus in position. In the decades preceding the advent of the present successful surgery of the pelvis, pessaries were very generally employed in the treatment of retro-deviations and cures were reported from their use. So much manifest injury, however, came from their employment that it has been very largely abandoned. Of the various pessaries employed in the treatment of this condition, one devised by Albert Smith for intravaginal application, and one by Gaillard Thomas for extravaginal support, were probably the most successful. If pessaries are employed the following axioms should be observed: An intrauterine stem should never be used; no pessary should be adjusted in the presence of either local or general inflammation within the pelvis; no pessary should be adjusted to an unreduced displacement; and no pessary should be continued in position after it begins to cause pain. If these rules are carefully observed it will be discovered that there are but very few pessaries that are adapted to the treatment of these cases.

J. Whitridge Williams (*Maryland Medical Journal*), while contending for the value of pessaries, says that it can not be asserted that they will "cure the trouble in all cases, even when we are able to replace the uterus. Indeed, the contrary must be confessed, if by cure we mean that the pessary will enable the uterus and its supporting structures to reassume their normal tone, and at last remain in place without its assistance. Such a result may be designated as an absolute cure, and

only occurs in about 25 per cent of the cases treated. On the other hand, in a much larger proportion of cases, the uterus remains in place and all the symptoms are removed as long as the pessary is employed, but recur as soon as it is removed. These we may designate as relative cures, and they occur in from 40 per cent (Sänger) to 60 per cent (Klotz) of all cases conscientiously treated."

The Surgical Treatment of Retro-deviations.—Many methods have been devised for the curing of backward displacements of the uterus. These may be included under three headings: First, Shortening the Round Ligaments; secondly, Ventral Fixation or Suspension; and, thirdly, Vaginal Fixation, as introduced by the German operators.

Shortening the Round Ligaments.—The idea of shortening the round ligaments for the cure of backward displacements of the uterus was first suggested by Alquié, of France, in 1840. This suggestion was not favourably received, and it was not until Alexander, of Liverpool, successfully performed the operation and carefully described the procedure, that the operation was accepted. Adams performed the operation independently a few months later; but it was undoubtedly Alexander's monograph, published in 1884, which induced other operators to follow his example, and placed the operation on a firm basis.

The idea of shortening the round ligaments internally originated with W. G. Wylie, of New York, who operated first in 1886. Bode, in 1888, did a very similar operation. Ruggi and Frank, also, did analogous operations about the same time. The operation has been further modified by Polk, Palmer Dudley, M. Baudouin, Mann, and others.

The shortening of the round ligaments through a vaginal incision was first done by Wertheim, and his procedure has been modified and improved upon by Bode and Kiefer, in Berlin, and by Byford, Vineberg, and Goffe, in this country.

The original operation of Alexander has stood the test of time and experience, and, with slight modifications of technique, is done by all who operate from the outside. Within the abdomen, the operation of Mann is accepted by many as the best; and through the vagina, the few who have operated in this country have generally followed either Byford or Goffe. As it is not necessary to describe the various steps in the evolution of these operations, only the three named will be fully described.

Alexander's Operation—*Indications.*—Alexander's operation may be properly performed in any backward or downward displacement in which there are no adhesions. Should adhesions exist, if not too numerous, they may be broken up before the operation, either by the conjoined manipulation, or, better still, by an incision through the posterior wall of the vagina into Douglas's pouch. When adhesions are present, there is usually, also, associated disease of the tubes and ovaries; so that in the majority of the cases of this kind, in Mann's opinion, abdominal section with intra-abdominal shortening of the ligaments is the better operation.

Where the uterus is greatly enlarged and the utero-sacral ligaments are also relaxed, very little benefit can be expected to follow Alexander's operation alone, because, although the fundus may be held forward, the cervix will slide down under the symphysis and the uterus will again get into the axis of the vagina, so that, in time, the round ligaments will give way, and the displacement will recur. In these cases it may be necessary for the patient to wear a pessary for some time after Alexander's operation, or the utero-sacral ligaments may be shortened, or Pryor's plan of opening into Douglas's pouch and packing this with iodoform gauze may be followed. (See page 305.)

Antiseptic Precautions.—It has been the experience of many operators that suppuration is quite prone to occur in this operation. This can be readily accounted for by the low vitality of the parts involved—adipose tissue and tendon—by the great amount of handling of the tissues, and by the depths of the cutaneous folds affording safe hiding places to the *Staphylococcus pyogenes albus* and other micro-organisms. Suppuration can generally be prevented by a very rigid asepsis. Unquestionably, the fingers of the surgeon are the great carriers of infection. While experiments show that it is impossible to perfectly sterilize the fingers, still, the dangers can be reduced to a minimum by careful scrubbing with soap and hot water, and subsequent immersion for at least five minutes in a 1-to-1,000 sublimate solution, or in the potassium permanganate and oxalic acid solutions.

The use of *rubber gloves* is the most certain way of preventing infection from the hands, and they should never be omitted. In a long series of cases done with gloves, not a single suppurative case has been met with. While the gloves at first seem to be a great obstacle, after a little practice their presence is scarcely noticed.

The most thorough disinfection of the patient's skin should be employed. After careful shaving, the parts should be covered with a green-soap poultice for some hours, and then thoroughly scrubbed, and a cloth wet in sublimate solution (1 to 1,000) placed over them and left there until the operation begins. Immediately before the operation, an additional scrubbing with alcohol and ether, followed by more sublimate solution, will diminish the chances of suppuration. During the operation all loose pieces of fat, torn muscle, or fascia, should be removed, and all blood vessels carefully tied or twisted, so as to prevent the formation of clots as far as possible. It must not be forgotten that the cut end of the ligament sometimes bleeds and may need a fine ligature.

The present *technique of the operation* shows that no improvements of importance have been made in the original plan suggested by Alexander. The patient, being properly prepared, is placed upon the table with the feet toward the light. The uterus must first be carefully replaced and a pessary introduced. In most instances it will be advisable to precede this by a thorough curettage of the uterus. Should there be a thorough retroflexion, it may sometimes be necessary to

introduce a stem pessary, in order to make the uterus rigid and to prevent the fundus from turning over round the pessary.

Having thoroughly cleansed the skin at the seat of operation and surrounded the parts with antiseptic towels, wet or dry as the operator may choose, either the spine of the pubis or the external abdominal ring is felt for. One or both can usually be readily distinguished. An incision is then made directly over the ring, a short distance above Poupart's ligament and parallel to it. The length of the incision will vary with the amount of adipose tissue present. In many thin persons, the incision may be less than an inch in length; two inches is the maximum length in any case. The fat and superficial fascia should be carefully incised until the tendon of the external oblique muscle is clearly and distinctly visible. This may be recognised by its white and glistening appearance. Between the fibres of this tendon may be seen the covering of the inguinal canal, which is recognised as a somewhat darker line slightly triangular in shape. The finger tip readily recognises the external ring.

With the scissors the intercolumnar fascia at the external ring is snipped, and immediately a small mass of fat will extrude itself. This may be picked up between the thumb and finger and slowly and carefully raised; or, should the operator prefer, a strabismus hook may be introduced and the tissues within the canal brought forward. These tissues always contain the cord spread out in fan-shape. By raising them carefully, the whitish fibres of the cord may be recognised. It should then be separated from the surrounding connective tissue and also from the nerve. The nerve should not be cut, but carefully laid aside. Then, with the fingers alone, without the use of any instrument, the cord should be slowly and carefully pulled out. In the majority of instances it comes out readily, increasing in size as the lower portions are brought up, until a large, white, fibrinous, structure is brought well in view. In some instances the pubic portion of the cord is exceedingly small and requires the most careful handling; but, if great care and delicacy are used, it may be slowly and gradually brought out until the large and well-developed cord is finally secured. If the cord comes with great difficulty, the intercolumnar fascia may be incised and the whole length of the canal laid open, thus exposing the cord at a point where it is usually larger and stronger.

Having been once brought out, the cord is allowed to fall back into its place, the pubic end being still connected, and the same procedure is followed upon the opposite side. Most operators prefer to change sides, and to stand upon the side on which they are operating.

The length to which the cord should be pulled out varies. In simple retroversions, a moderate amount of shortening is all that is needed. Should the parts be very much relaxed and the uterus enlarged and prolapsed, a greater amount of shortening will be required. No positive rule can be given for this; the judgment of the operator must decide in each case. Both cords being loosened and all hemor-

rhage stopped, the pubic end of one cord is cut close to the pubis, and the cord drawn out and held by an assistant, well up to the abdominal wall. A stitch of catgut is passed through one pillar of the ring, and then through the cord and the opposite pillar. The same stitch is then passed through these tissues in reverse order, the two ends being brought out on the same side. This mattress suture serves to keep the cord in place and effectually to close the canal. The cord is then cut off half an inch beyond the last stitch. Should the inguinal canal be still open to any extent, this should be closed by additional catgut stitches.

This procedure having been completed on both sides, the wounds are closed by deep stitches of fine catgut. An antiseptic dressing is applied and held in place by adhesive straps. The bandage devised by Dr. Kelly, and known by his name, has proved very serviceable in still further holding the dressings in place.

There are several *complications* to be taken into account *Adhesions in the inguinal canal* sometimes effectually prevent the drawing out of the cord. In three cases seen by Mann, the cord was so firmly attached on one side, that it was impossible to draw it out, there having been in each case an inflammatory condition with pus-formation in the neighbourhood of the canal. Upon the opposite side, in each of these cases, the cord was drawn out as usual. It is questionable whether the operation should ever be undertaken under such circumstances. The shortening of one cord is hardly sufficient to keep the uterus in place, although it may help, and occasionally succeeds perfectly.

We can never predict whether we shall encounter *a delicate cord* or a strong one, in any given case. In young women who have never borne children, or in whom the uterus is not well developed, the ligaments are sometimes very small and ill defined. In women who have passed the menopause, and in whom the uterus is atrophied, the atrophic process seems often to include the round ligaments; and in these cases the result of Alexander's operation is not so sure. From these or other causes, the cord is at times so delicate, especially at the pubic end, as to be pulled out with the greatest difficulty. Unless the utmost gentleness is used, it will be broken, and then all clew to its position is lost. By working very slowly and carefully, and opening up the inguinal canal to its full extent, the cord can usually be pulled out, even in the worst cases. Considerable time must be taken, as hurry will surely result in failure.

In a few instances *the cord will break*. If this occurs at the pubic end, and the uterine end of the cord can be kept in view, it may be carefully followed up until it becomes large enough to be firmly seized and so be pulled out. It is impossible to pull upon the cord with a hemostat or any instrument, for, no matter how carefully it is done, it will crush and cut the cord. The cord must always be pulled with the fingers, and the fingers alone. As the gloved fingers are slippery, it

is well, until the cord is entirely loosened, to keep its pubic end attached. In pulling on the cord, it must always be remembered that the force should be applied in the direction of the inguinal canal.

If the uterine end of the cord breaks after it has been nearly freed, the difficulties of securing it again are very great. The only chance then will be to follow up the inguinal canal and to open into the abdominal cavity through the internal ring. Goldspohn, of Chicago, recommends that the internal ring should be opened in all cases, and he inspects and operates upon the tubes and ovaries in this way. Mann has performed this operation several times, removing diseased ovaries and tubes before shortening the round ligaments. It does not seem to be generally advisable to adopt this procedure, as the median operation, with the internal shortening of the round ligaments, would seem to be safer and easier. By pulling up the horn of the uterus, the broken end of the round ligament may sometimes be found; but the operation may fail because the cord is broken so close to the uterus that there is not sufficient to sew even to the internal ring.

The operator is sometimes embarrassed by *anatomical abnormities.* In a few instances, the cord has been found not to run through the inguinal canal. Doubt may be thrown upon some of these cases, as only the most careful dissection post-mortem would be sufficient to prove that the cord is not there. Failure to find the cord will be less frequent as the operator becomes more experienced. By keeping the anatomic landmarks carefully in view, and by making sure that the tendons of the external oblique muscle, with the external ring, are clearly exposed, and that the incision is made between the pillars of the ring and not to one side, very few failures will be encountered. In about 1 per cent of cases the *canal of Nuck* will be found to be open from the internal ring to the symphysis. In these cases the round ligament is always found embedded in the walls of the canal and can not be separated, and the shortening of the ligaments is impossible. The fact that there is a persistent canal of Nuck on one side does not prove that the same condition exists upon the opposite side. *Inguinal hernia* in the female is comparatively rare, but, when found, often coexists with retroversion. In these cases, the shortening of the round ligaments and the cure of the hernia can be done together. The round ligament will usually be found upon the hernial sac, and must be carefully searched for before the sac is cut off.

The *after-treatment* is very simple. The patient should be kept in bed for eight or ten days, and the wound left untouched, unless the temperature goes up. At the end of that time the dressings may be removed; when the wound should be found perfectly healed. Upon the tenth day, the patient may be allowed to sit up, and may leave her room as soon after as her strength will permit. The pessary which was introduced at the time of the operation should be worn for two or three months; and, if there is much relaxation of the utero-sacral ligaments, it may be necessary to keep it in for a longer period.

Intra-abdominal Shortening of the Round Ligaments—Mann's Operation.—The operation here to be described is a modification of the procedure first suggested by Wylie (Fig. 121). It has been described by Mann in the *American Gynecological Transactions* for 1897. It was first done in June, 1893.

The special *indications* for this operation are a backward displacement and such complications with other diseased conditions as to make the opening of the abdomen advisable. It can be done, therefore,

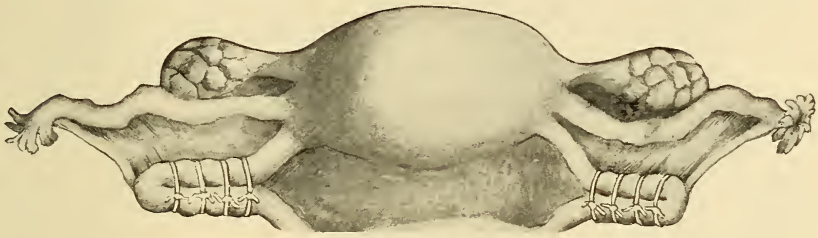

Fig. 121.—"The procedure first described by Wylie."—Mann.

where it is necessary to open the abdomen for reparative work on diseased tubes and ovaries, for the breaking-up of adhesions, the removal of one tube and ovary, or the removal of ovarian cyst or pedunculated fibroid. It may also be done when Alexander's operation has been tried and has failed, or is contraindicated for any reason. In any abdominal section for pelvic disease, if the uterus is displaced backward, this or some operation having a similar purpose should be done. Where both tubes and ovaries are removed, or when pregnancy can not possibly occur, some might prefer ventral fixation. This operation does not compete with Alexander's operation, as it fulfils entirely different indications.

The abdomen being opened, the *technique of the operation* is as follows: Adhesions are broken up, and any other necessary operative procedure completed. The patient is then placed in the Trendelenburg position, and the abdominal retractors put in place. A large, flat sponge is spread over the intestines, and the uterus is seized by a small volsella forceps and pulled up to the abdominal wound. The round ligament on one side is made tense by pulling the uterus to the opposite side, and is then seized by two hemostatic forceps, the points of seizure dividing the ligament as nearly as possible into three equal portions.

Next, a needle, threaded with silk, is passed through the angle in the round ligament made by pulling upon the hemostat. This passes, therefore, twice through the ligament at points quite near to each other. It is then passed through the wall of the uterus at the point where the round ligament is inserted into the anterior uterine wall. It is well that a considerable quantity of uterine tissue be included in this suture. The usual method of passing the sutures through the anterior wall of the uterus is wrong (Fig. 122).

The hemostat being removed, the loop of the ligament is tied to the uterus. A second stitch is passed through the ligament just as it leaves the abdominal wall, and then through the second angle in the round ligament at the site of the other forceps. This ligature is tied

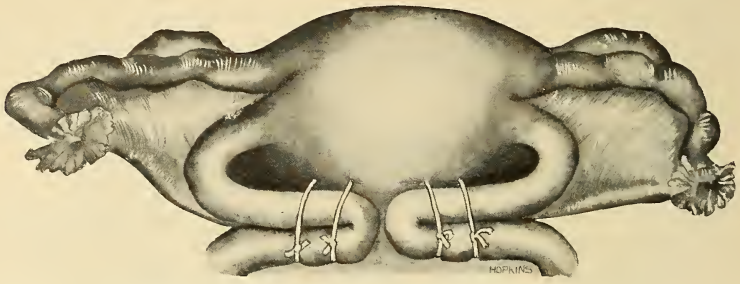

Fig. 122.—"The usual method of passing the suture through the anterior wall of the uterus is wrong."—Mann (page 299).

and cut as before. In this way the ligament is doubled on itself, and three thicknesses of round ligament are stretched between the sides of the pelvis and the wall of the uterus. The same thing being done upon the opposite side, the wound is closed in the usual manner.

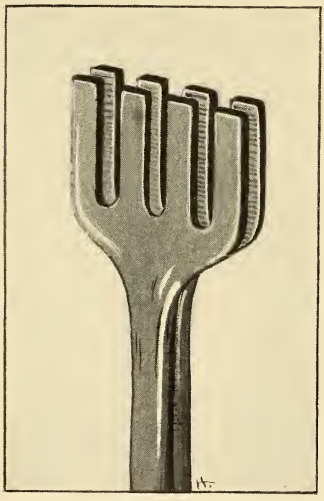

Fig. 123.—"A forceps with four flat approximating prongs, the whole being an inch or more wide."—Reed.

Reed has adopted Mann's operation as the one of choice in practically all retro-deviations of the uterus. He employs a forceps, having four flat approximating prongs, the whole being an inch or more wide, with which to seize the round ligament in its middle (Fig. 123). A half turn of the forceps makes the desired fold in the round ligament (Fig. 124). The folds of the ligament are now fixed at the uterine and parietal ends as already described, interrupted sutures being employed; the middle zone is next fixed by a continuous suture passed between the prongs of the forceps. The result is a triplicate ligament of desirable shortness and great strength (Fig. 125).

The character of the suture material with which the round ligaments are sewed up is of some importance. Silkworm gut is satisfactory, and has been used in many cases without harm; and, should an abscess occur and the removal of the suture be found necessary, it can be more easily found than a suture of any other material, as the sharp cut ends can be appreciated by the sense of touch. Catgut, which is readily absorbed, may produce adhesions, but the adhesions are

not always permanent, and some cases of failure, or, rather, of recurrence, have been reported. In one case operated on by Mann, in which catgut was used, in the year subsequent to the original operation all traces of the doubling of the ligaments had disappeared. For this reason an unabsorbable ligature seems preferable.

The *results* as shown by a number of cases which have been reported by different operators have been satisfactory. When pregnancy has occurred after this operation, the labour has been entirely normal in each instance. As the uterus is held in its normal position, and as the round ligaments can stretch and grow as well as they could were they not stitched together, there is no reason why pregnancy and labour should be interfered with in any way by this operation.

The *after-treatment* is that which is usual for cases of abdominal section.

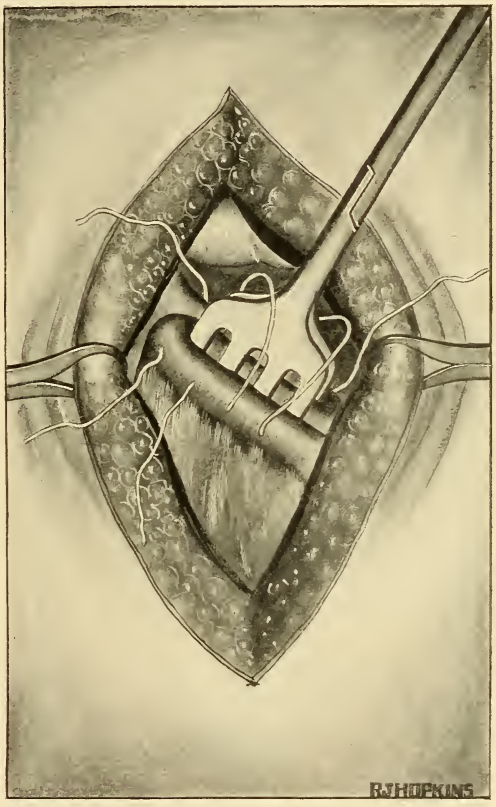

Fig. 124.—"A half turn of the forceps now makes the desired fold in the round ligament."—Reed (page 300).

For those who prefer the vaginal route, the operations of Goffe or Byford for **shortening of the round ligaments through the vagina** are practical and give good results, though they are confessedly more difficult of performance than where the round ligaments are shortened through an abdominal incision.

For those who are skilled in vaginal work, this operation may be *indicated* whenever the uterus is displaced, whether there are adhesions and tubal and ovarian disease or not. Unless the adhesions are very dense and the disease of the adnexa extensive, they can all be treated through the vagina, thus widening materially the indications for this operation over that of Alexander, and bringing it in direct competition with the abdominal operation.

Goffe's Operation.—Goffe, after placing the patient in the dorsal position, with the thighs well flexed, seizes the cervix through a specu-

lum, and pulls it strongly away from the pubis. An incision is then made halfway round the uterus, through the vaginal wall. Another incision at right angles to this, in the median line, converts the opening into a T-shaped incision. Through this, the bladder is carefully separated from the vaginal wall by the finger, and the peritoneum opened. The fundus of the uterus is next pulled down until the round ligaments are brought into view. They are then doubled upon themselves in two places, much as in Mann's operation. It is impossible, however, to get the outside stitch as near the pelvic wall as is done when the abdomen is opened. Otherwise, the operation is practically the same. With the uterus pulled down through the vaginal wound, the tubes and ovaries can be inspected and operated on, if desired, and adhesions broken. After the ligaments have been shortened, the vaginal wound is closed with catgut sutures and a small opening for drainage left, if thought desirable, though usually this is unnecessary. The vagina is then dusted with iodoform, and the patient placed in bed.

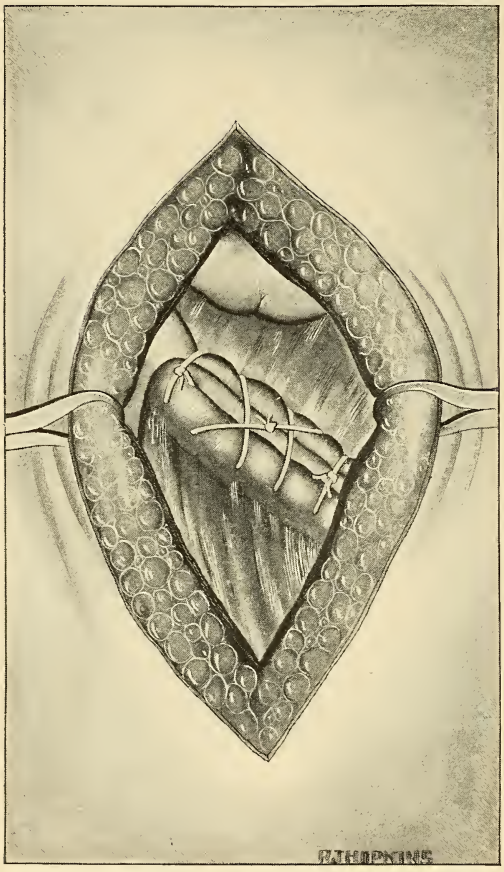

Fig. 125.—"The result is a triplicate ligament of desirable shortness and great strength."—Reed (page 300).

Byford's operation differs from the procedure of Goffe in that he draws down the fundus of the bladder and stitches the fundus of the uterus to the post-pubic peritoneum, which is drawn down after the bladder but recedes upward when released, and draws the fundus with it. The fundus is thus sutured to the peritoneum over the bladder, much in the same way as in abdominal hysteropexy.

For the suture of the bladder to the fundus, he uses formalinized catgut, placing two stitches about an inch apart. He draws down the round ligaments and uterine horns into the vagina, suturing the for-

mer as taut as possible to the uterus just above the uterine insertion. As he finishes the suturing of the ligament, he throws the same catgut thread around the neck of the loop thus formed, and ties it securely. This last step he considers an important detail. He pays no attention to the remainder of the loop, which forms adhesions to the bladder and uterus just below the sutures. After all intraperitoneal oozing has ceased, he closes the peritoneum with fine catgut and the vaginal wound in the ordinary way.

Byford asserts that the simple shortening of the round ligament is not sufficient, because, if it depends simply on adhesions, these adhesions will stretch and give way, and allow a recurrence of the displacement. This objection does not hold if a nonabsorbable ligature is used in the shortening of the ligaments. Byford reports a number of cases with generally satisfactory results.

The principal *complication* which is likely to give trouble is narrowness of the vagina. This is particularly the case in virgins and in women past the change of life, in whom atrophy has occurred. The narrow vagina makes the operation very much more difficult, and may be a positive contraindication unless the operator is an adept. Extensive disease of the tubes or ovaries may also contraindicate this method of operating, and may even, where it has been begun, necessitate its abandonment, and the opening of the abdomen instead.

This method has the great *advantages* of rapid recovery, absence of an unsightly scar, and freedom from danger of ventral hernia. As compared with the abdominal operation, it is more difficult of performance, requires a large experience in vaginal work, and occasionally it is even necessary to open the abdomen to complete it—this, however, only in the presence of formidable complications. As compared with Alexander's operation, it is much more difficult and more dangerous. In simple cases the vaginal operation should always give way by preference to the Alexander.

Vaginal Fixation.—Under this heading Mann includes all those operations which have for their purpose the fixation of the uterus through the vagina. Either the body or the neck of the uterus can be fixed directly; or it can be fixed indirectly by acting upon the vaginal walls.

Fixation of the fundus originated with Rabenau (1886); but at present there are a number of methods of performing it in use, and no one fixed method seems to be generally adopted. The *operation employed by Müller* is as follows: After curetting in the usual way, the uterus is pushed into a position of anteflexion by means of Orthmann's instrument, and drawn strongly downward. (See Macnaughton Jones, *Diseases of Women*.) The anterior vaginal wall is then cut from the point of insertion into the cervix almost to the meatus urethræ. If a cystocele is present, an oval of mucous membrane upon the anterior vaginal wall is removed. The bladder is then separated from the vagina, the former being drawn up and held by a retractor. Great care

must be taken to have the bladder thoroughly separated, in order to avoid injury by suture or pressure by the uterus. The fundus is then reached, and half a dozen strong catgut sutures are next passed transversely in the anterior uterine wall, beginning at the wound above. The points of entrance and exit of the stitches are 2 centimetres apart. Then these stitches are carried through the edges of the wound, 1 centimetre from the margins. The sutures are not tied yet, but the vaginal wound is closed; after which Orthmann's instrument is removed and the sutures tied in the order of insertion. The uterus, being in a position of anteversion, is held there by a firm tamponade of the vagina with iodoform gauze. In *Mackenrodt's operation*, after separation of the bladder from the uterus and the opening of the abdominal cavity, the anterior flap of the peritoneum is stitched to the front of the uterus, and then to the posterior surface of the bladder, thus closing the vesico-uterine pouch. A. Martin does an *intraperitoneal vaginal fixation* after colporrhaphy in a somewhat similar way. In this country, Vineberg has practised an operation which involves both the shortening of the round ligaments and the anterior fixation of the uterus. All of these operations of anterior fixation have the very great disadvantage that they interfere more or less with pregnancy; and in the earlier cases, where the fundus was fixed to the vagina, very serious results followed. These earlier methods have been almost entirely given up, and seem to have very little place in gynecological practice.

Besides the methods described, there are a variety of others, each operator seeming to have a plan of his own. It is not thought advisable to multiply descriptions of slight modifications of technique.

Fixation of the cervix has been attempted, the object being to fasten it back in the hollow of the sacrum. It can be readily understood that, if the cervix is held upward and backward in the sacrum, the fundus will be thrown forward. This may be done either by shortening the utero-sacral ligaments, or by causing adhesions between the posterior surface of the cervix and the rectum—in other words, by obliterating Douglas's cul-de-sac. The operation for shortening the utero-sacral ligaments has not been successful, no technique having been developed which could make the operation available. Mann made attempts to do this a number of years ago, putting the patient in the Trendelenburg position. In this way each utero-sacral ligament was folded upon itself and sewed with catgut. In some cases it may be done with comparative ease, but in the majority of cases it is a very difficult matter, and the results have not been altogether satisfactory. Freund has proposed to shorten these ligaments by sewing them to the posterior wall of Douglas's pouch. Probably the best operation is that suggested by W. R. Pryor. His plan is as follows:

Pryor's operation is done by preparing the patient locally and generally as for a capital operation. After the uterus is curetted, the cul-de-sac is opened, the patient being in the dorsal position. If no pus is found, the operation is then continued. The tubes and ovaries

are treated as circumstances may require. After this, the pelvis is wiped dry and a gauze pad inserted. The patient is placed in the Trendelenburg position and the gauze pad removed. After the uterus has been packed with iodoform gauze, a piece of the gauze sufficiently wide to fill the vaginal opening, and about an inch and a half long, is inserted just within the edges of the vaginal wound. Over this enough strips are placed to fill the incision in the vagina. The uterus is then put in place, the gauze plug being carefully retained in position. Holding the uterus in place by the tampons pushing against the cervix, pieces of gauze are inserted to the sides of the cervix and in front of it, until the vagina is filled to the margin of the levator-ani muscle. The operator now takes a stout roll of gauze, as thick as his thumb, and about two inches long. This Pryor calls the gauze pessary. One end of this is introduced in front of one side of the cervix, just behind the levator-ani fibres, and the other end is pushed into a similar position on the other side. This plug lies transversely across the vagina and in front of the cervix. It will prevent the descent of the cervix, even in the face of the most severe vomiting. The uterine packing should be so arranged that it can be removed without disturbing the anchoring plug. (Fig. 36, p. 120, *Pelvic Inflammations*, Pryor.)

A self-retaining catheter is introduced and is left in for two days.

The *after-treatment* is important. In from seven to ten days, the patient is placed in Sims's position and all the dressings are removed and replaced exactly as they were at first. The operation will fail unless the supporting plug is properly inserted. Dressings are continued as long as there is any raw surface in the vaginal vault. The supporting tampon is used for six weeks. The cervix must be kept pressing high and backward until the cul-de-sac opening closes and the posterior cervical scar is healed.

Among the *advantages* claimed for this operation are that it leaves the corpus uteri perfectly in place, pregnancy is uninterrupted, and labour normal. The laceration and diseases of the cervix and perineum, according to Pryor, are to be corrected by subsequent operations, and not done at the time of the cul-de-sac operation. This is certainly a disadvantage as compared with Alexander's operation, which may very properly be joined with the various plastic operations on the vagina, cervix, and perineum.

This operation *may be done* in any case of retroversion, and is especially indicated when the utero-sacral ligaments are relaxed, particularly in cases of retroversion with prolapse. It may be combined with Alexander's operation in cases of great relaxation. When the backward position is accompanied by occluded tubes, by hydrosalpinx, or by cystic ovaries, Pryor thinks this is the preferable operation; but when pus is present in either tube or ovary, he thinks laparotomy preferable.

Ventral Fixation.—Under this head it is proposed to consider all the operations by which the uterus is fastened, either directly or indirectly to the abdominal wall. According to Delagénière, this opera-

tion was first done in 1869, by Koeberlé, who, after removing an ovary, fastened the pedicle into the abdominal wound. Lawson Tait first fixed the body of the uterus to the abdominal wall by passing a ligature through the fundus and through the edges of the wound. These two operations represent the direct and indirect methods which have been developed by later operators.

Direct fixation of the fundus to the abdominal wall may be accomplished in two ways—either by passing ligatures so as to simply approximate the peritoneal surfaces; or the fundus may be sewed to other structures of the abdominal walls. In the *first method* the suture is passed first through the fascia, subperitoneal fat and peritoneum, and then through the posterior wall of the uterus a little below the fundus. It then passes through the opposite edge of the wound, coming out above the fascia. A similar stitch is passed a quarter of an inch nearer the umbilicus and a little lower upon the uterine wall. These stitches, when tied, approximate the posterior surface of the fundus to the abdomen; adhesions then form, and in time the peritoneum pulls down, forming what has been described as a "suspensory ligament."

The *second method* is employed in cases of great enlargement of the uterus, and particularly in cases of prolapse, in which the adhesions formed by the first method are not sufficient to permanently support the uterus. Under these circumstances, it is well to attach the uterus more firmly. It may then be drawn out of the abdominal wound and the peritoneum sewed with a running suture entirely around the fundus, going farther down upon the posterior wall than upon the anterior. In this way half an inch of the fundus is brought above the peritoneum. It is then sewed firmly with buried catgut stitches to the fascia and the edges of the recti muscles. In this way very firm adhesions are formed and the most obstinate case of prolapse may be relieved. Kelly inserts the sutures through the peritoneum and fascia in such fashion that, when tied, the knots are within the peritoneal cavity (Fig. 126). In Mann's experience this method is satisfactory, but should never be performed in cases where pregnancy may possibly occur. It is especially indicated in women past the menopause, in whom very great relaxation of the vagina and perineum exists.

The needle which should be used in this operation should have no cutting edge. The needles known as Emmet's vesico-vaginal-fistula needles are particularly appropriate, having large eyes and a round body with a slight curve. If such needles are used no hemorrhage will occur from the puncture of the uterine tissue. If the uterus is brought up against the line of the abdominal incision, sufficient adhesions will take place. If, however, it is brought up against a portion of peritoneum which has not been cut, then either the uterus or the peritoneal surface against which it is brought should be scarified. The early operators used silk, but to-day nearly all writers recommend the use of catgut. The chromatized or formalinized catgut is prefer-

able, as it lasts longer and creates more irritation, and stronger adhesions are consequently formed. By bringing the posterior surface of the uterus in contact with the abdominal wall, intra-abdominal pressure is brought to bear upon the posterior surface in such a way that there is no tendency to a recurrence of the malposition.

The *indications* for this operation, by either method, would seem to be limited to those cases in which pregnancy is impossible, and where

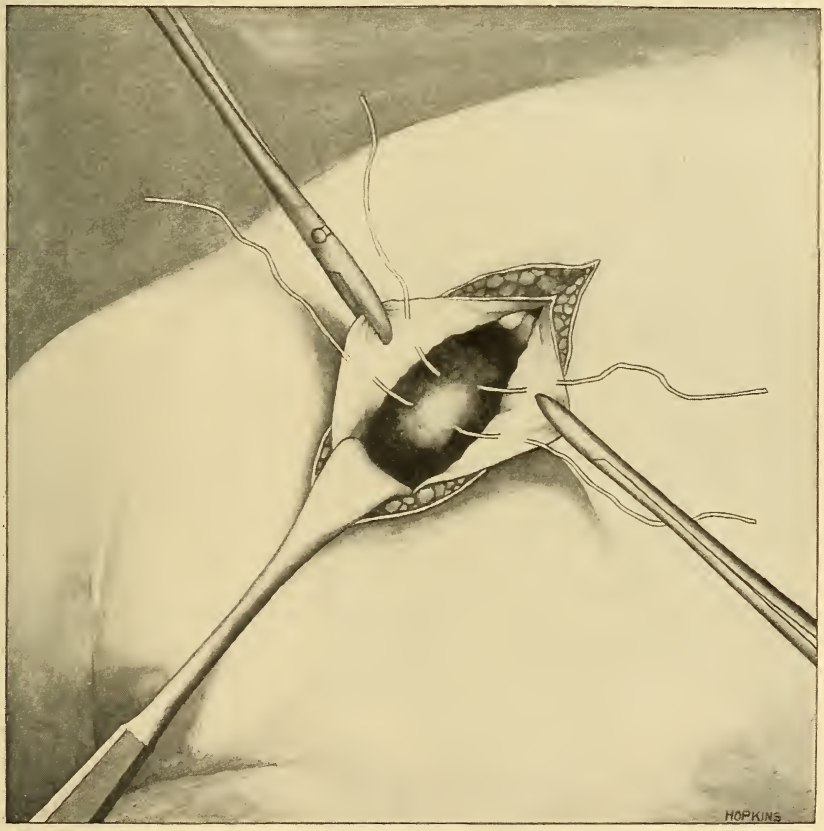

Fig. 126 (Redrawn from Kelly).—"Kelly inserts the sutures through the peritoneum and fascia in such fashion that when tied the knots are within the peritoneal cavity."—Mann (page 306).

the abdomen is opened for some other purpose; also to cases of very severe prolapse with great relaxation, as already mentioned. Where there is a possibility of pregnancy the operation should not be done, as a large number of cases have been reported where pregnancy and labour have been materially interfered with by the binding down of the fundus uteri.

Indirect Ventral Fixation.—Dr. A. H. Ferguson (*Journal of the American Medical Association,* November 18, 1899) describes a method

of transplanting the round ligaments and attaching them to the abdominal wall. After the usual preliminary antiseptic precautions, he opens the skin of the abdomen in the median line, the incision being three inches in length and beginning an inch and a half above the symphysis. The linea alba and the anterior sheath of the recti muscles are exposed, and an incision is made on either side through the anterior sheath of the rectus. The rectus muscle is retracted outward, and an incision is made directly behind it into the peritoneal cavity through the transversalis fascia and the peritoneum.

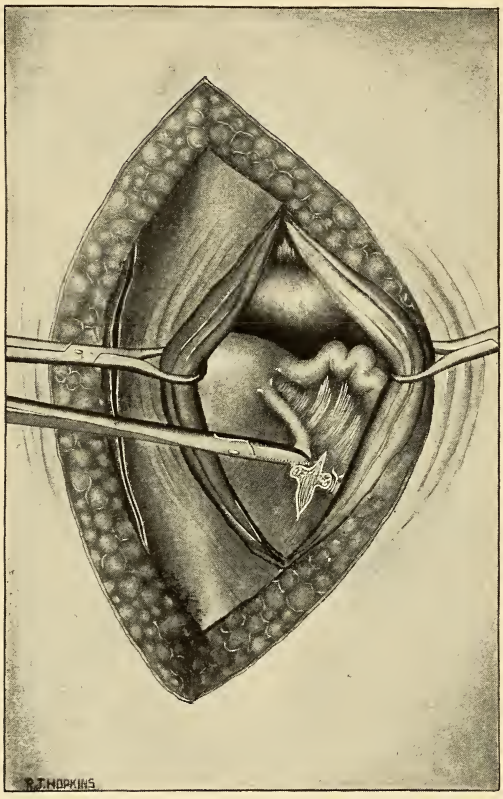

Fig. 127.—"Next [in Fergusson's operation], the round ligament and the portion of the broad ligament, are seized by forceps, one inch from the origin of the former . . . tied . . . and divided."—Mann.

Next, the round ligament and the portion of the broad ligament are seized by forceps one inch from the origin of the former at the internal ring. These structures are then tied, externally to the forceps, and divided (Fig. 127). The distal end of the round ligament is dropped into the peritoneal cavity, and the proximal end is also pulled well out of the wound into it. The round ligament and its accompanying portion of the broad ligament are next sewed with catgut to the margins of the wound in the transversalis fascia and peritoneum (Fig. 128). The fibres of the rectus muscle are then replaced, and the opening in the anterior sheath closed with continuous catgut suture, which grasps the end of the round ligament.

A similar operation is carried out upon the other side of the median line, and the incision closed.

Dr. Ferguson claims in this way to get a firm support for the uterus, which is not adherent to the abdominal wall, but is suspended free in the pelvis and capable of motion. He reports twenty-two cases operated

on in two and a half years, with ideal results. One of the patients became pregnant, and the pregnancy went on to normal termination.

The *indications* for this operation are the same as for intra-abdominal shortening of the round ligaments, for which it may be substituted.

In *comparing these various operations* for the treatment of posterior displacements, it will be seen that each has its special indications, and no operator should become so attached to one method as to employ this to the neglect of the others. Alexander's operation unquestionably fulfils the indications in a large majority of simple cases. Where adhesions have occurred, if they are slight, they may be broken up through a vaginal incision, and Alexander's operation done afterward.

In view of the excellent results obtained by Alexander's operation, the opening of the abdomen for ventral fixation alone is scarcely warranted in simple cases. Where the abdomen is opened, and the tubes and ovaries left in such a condition that pregnancy may occur, then the intra-abdominal shortening of the round ligaments would seem to offer better chances of permanent cure without interference with gestation.

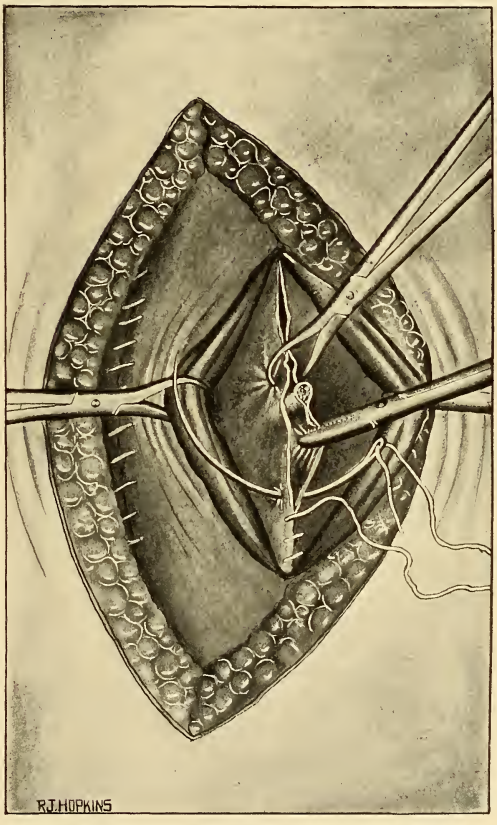

Fig. 128.—"The round ligament and its accompanying portion of the broad ligament are next sewed with catgut to the margins of the wound in the transversalis fascia and peritoneum."—Mann.

If serious disease of the tubes and ovaries exists, then either the abdomen must be opened or the vaginal operation done, as the operator may elect. For an operator with small experience, the abdominal operation unquestionably offers the fewer obstacles. For those skilled in vaginal work, the vaginal operation causes the woman the least trouble and annoyance from the operation. Where the abdomen is opened for other cause, and pregnancy is rendered impossible, either by disease, age, or the operation, then ventral fixation would seem

to be the simplest and easiest of performance, and to give promise of equally good results. Vaginal fixation has found little favour in this country, and, in view of the great difficulties encountered where pregnancy has followed, should never be done in women liable to become pregnant. The tendency in this country, even among those who have been its advocates, seems to be to substitute some other form of operation for it.

Anterior Abdominal Cuneohysterectomy for Retroflexion of the Uterus.—In 1895 Reed applied Thiriar's operation of *cuneohysterectomy* to the anterior wall of the uterus for the relief of retroflexion. Jonnesco made a similar adaptation of the operation in 1897. The technique does not differ in any essential particular from that described in the treatment of anterior displacements of the uterus, except that the site of operation is the anterior instead of the posterior wall. Reed has done the operation but a very few times because the indications in retro-deviations generally are more effectively met by the operations upon the uterine ligaments, as described under another heading. The operation of anterior cuneohysterectomy is indicated only in those cases of retroflexion presenting marked hypertrophy with induration of the convex wall. When this condition exists, the removal of an elliptical segment is necessary to restore the organ to its normal axis.

Jonnesco and Reed perform this operation in connection with shortening of the round ligaments.

Ante-deviations.—The facts that the uterus occupies normally a position of anteversion and that there are no definite lines by which its normal position may be prescribed and limited, make it relatively difficult to determine when an anterior displacement exists in a pathological degree. This is particularly true of anteversion; while the detection of a point of flexure in the axis of the uterus on its anterior surface is conclusive evidence of the existence of an anteflexion.

The *symptoms* of forward displacements are pain in the sacral region with more or less vesical irritation and tenesmus; dysmenorrhœa and sterility are usually present. The *diagnosis* is generally made without difficulty by bimanual examination. The fundus is felt to occupy a position anterior to its normal plane, the cervix generally pointing backward. If, with the patient lying upon her back, the finger is passed behind the cervix and the latter is drawn forward toward the pubis, the fundus will naturally be drawn upward and backward; and if, when the force is removed from the cervix, the uterus returns to the state of extreme anteversion, it may be known, not only that forward displacement exists to a pathological degree, but also that the anterior wall of the uterus is attached to the fundus of the bladder. The existence of a point of flexure on the anterior wall about the cervico-corporeal junction will establish the difference between anteversion and anteflexion. It should be remembered that a small subperitoneal fibroid on the anterior wall may feel like anteflexion—and the difference may not be detected without the use of the sound or an

abdominal section. The sound ought to be employed only under circumstances of exceptional importance.

The *pathology* of ante-deviations, like that of other forms of displacement, is not confined to the uterus itself, but embraces a consideration of important changes in its suspensory apparatus. In the organ itself, however, in anteversion there frequently exists a condition of hyperplasia, and, occasionally, of neoplastic growth that makes the organ top-heavy, as it were, and acts as a potent cause in producing and maintaining a displacement. In other cases of anteversion parenchymatous changes are sequent rather than causal. When this deviation exists to such a degree as to interfere mechanically with the circulation—particularly on the venous side—more or less passive congestion of the organ results. This is expressed, not only in the gross enlargement of the uterus, but in the thickening and excessive epithelial growth of the endometrium. In anteflexion important structural changes are added to those already enumerated. If the angle of flexure is acute, atrophy of the uterine wall occurs at the point of angulation on the concave side, while hypertrophy is likely to occur on the convex side (Fig. 131). (See Pathology of Retro-deviations.) Contraction of the utero-sacral ligaments, whether as a cause or as a consequence, generally exists in connection with forward displacements. It is probably a causative factor in many cases and one to be taken in account in the treatment. When the uterus is displaced forward in an extreme degree, the fundus of the uterus riding upon the fundus of the bladder, adhesion of the proximal peritoneal surfaces is liable to occur, particularly in the presence of infectious inflammatory conditions within the pelvis. When this complication exists, there is always more or less inflammatory mischief in the wall of the bladder. Extreme ante-deviations imply more or less constant tension on the broad ligaments, which, sooner or later yielding to this influence, become relaxed and cease to exercise their function of holding the uterus in its natural poise.

The *treatment* of forward displacements of the uterus, aside from surgical measures, has been unsatisfactory. Pessaries, while occasionally affording temporary relief, have more frequently caused discomfort and damage. Graily Hewitt's cradle pessary at one time had a considerable vogue, but it, like its congeners, is now generally abandoned. The judicious use of tampons has been attended with comfort and followed by substantial improvement. When acute pain exists with forward displacements the patient should go to bed, take a laxative, and be given frequently repeated hot douches, with occasional glycerine tampons. A case that can be controlled by a pessary can, in all probability, be relieved with equal efficiency and greater comfort by the measures just enumerated. When, however, in spite of careful attention to the details given, forward displacements exist to such a degree as to interfere with health, recourse should be had to surgical treatment.

Forward displacements of the pregnant uterus occur either by relaxation of the abdominal wall or by a ventral hernia. Sometimes the entire gravid uterus occupies a large hernial sac (Fig. 129). A support should be furnished to the protruding mass until delivery lessens its volume and renders it reducible. The case after this period is to be recognised and treated as one of ventral hernia.

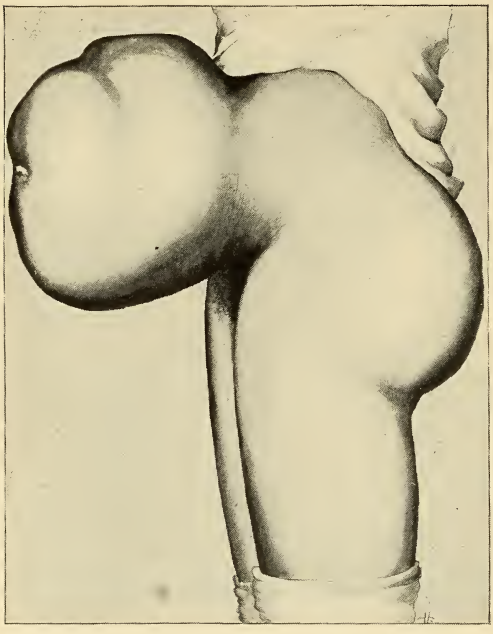

Fig. 129.—"Sometimes the entire gravid uterus occupies a large hernial sac."—Reed.

The *surgical treatment* of forward displacements has as yet embraced no operation for *anteversion* of the uterus. Where that condition is due to retraction and shortening of the utero-sacral ligaments pulling the cervix upward and backward, and thus throwing the fundus too far forward, it has been proposed to cut through the posterior vaginal wall and resect the ligaments, thus allowing the cervix to come forward and assume a more normal position. This operation is rarely necessary.

It has also been proposed to do Alexander's operation in these cases, and to raise the fundus by the round ligaments. As the round ligaments were never made for this purpose, it is not likely that the operation would be permanently successful. At any rate, these operations have never achieved a position in gynecological surgery, and are rarely even mentioned in literature.

A history of the operations which have been devised for the cure of pathologic *anteflexion* would form a very interesting chapter. From the operations of Simpson, Sims, and Peaslee, down to the present time, very many operations have been devised, all having for their object the straightening of the uterine canal. The earlier operations of Sims were not successful, owing, however, largely to the conditions in which they were done—the want of a proper aseptic technique. The later operations which have been done have been much more successful and satisfactory. The majority of operators, however, are content with the operation of forcible dilatation, usually conjoined with curetting.

Dilatation and Curetting.—This was suggested by Dr. John Ball, of Brooklyn, in 1877 (*New York Medical Journal*, vol. xviii, p. 363).

Ellinger did a similar operation, and Goodell modified Ellinger's dilator and followed Ball's method, and was the first to popularize it in this country. Hanks also operated about the same time, using graduated dilators instead of the expanding dilators of the other operators. That dilatation is better than cutting is now generally admitted, and the large number of good results which have followed it has made this one of the most beneficent operations in gynecological surgery. That it cures the flexion is not asserted by its most ardent supporters; but that the flexion is benefited and the symptoms relieved, is, in the majority of cases, generally admitted.

This operation is *indicated* in any uncomplicated case of anteflexion where the flexion seems to be productive of symptoms. There is usually present an endometritis, and this has more to do with the symptoms than the flexion, and is, in turn, largely the result of the flexion. The operation has in view, not so much the cure of the flexion, as the relief of the complication—that is, the endometritis.

Technique.—The patient being anæsthetized and placed upon the table, with the hips overhanging the edge and the thighs held in place by suitable legholders or assistants, the vagina is thoroughly scoured with gauze and green soap. The advisability of this procedure has been doubted by some, as it is a well-known fact that the normal vagina is aseptic. While this is generally admitted, it is not true in morbid conditions; and, as we can hardly make a complete bacteriological investigation in every case, it is better to be upon the safe side and thoroughly to wash out and disinfect the vagina. After the scrubbing with the green soap, the vagina should be washed with a solution of bichloride (1 to 3,000). An Edebohls's or Jones's speculum is then introduced, and the cervix seized with the traction forceps and pulled down toward the vulva. After the direction of the cervical canal has been carefully made out by the uterine sound, a small uterine dilator (Hanks's or Palmer's) is introduced, and sufficient dilatation effected to admit the introduction of the Ellinger-Goodell dilator. With this the cervix may be forced open, at least up to the inch and a quarter mark upon the index. A few minutes should be allowed for this, as the uterus is sometimes very friable, and too rapid dilatation may tear the tissues. When the dilatation is complete, the uterus should be washed out with the bichloride solution, and then thoroughly curetted with the Sims sharp steel curette. After this, it is again washed, and packed with iodoform gauze.

Some operators, instead of packing with gauze, prefer to introduce a large stem pessary, half an inch in diameter, and then to pack the upper part of the vagina around the stem with iodoform gauze.

If the cavity of the uterus has been packed with gauze, the gauze may be removed on the fourth day, or sooner if it causes too much pain. If the glass stem has been introduced, upon the fifth day the stem should be withdrawn, the interior of the uterus carefully washed out with peroxide of hydrogen, and mopped out with a 5-per-cent

solution of ichthyol and glycerine. The stem should then be reintroduced, and a tampon of cotton or iodoform gauze put in, to keep it in place. This procedure should be carried out daily until all the tenderness upon the interior of the uterus has disappeared.

The patient should be kept in bed for four days, though she may be allowed to sit upon the commode for the purpose of emptying the bladder and bowels. After this, she may be up and dressed, and gradually resume her ordinary mode of life.

In this way a very large proportion of cases will be relieved, not always of the anteflexion, but of the symptoms to which the anteflexion has given rise.

Dudley's Operation.—Dr. E. C. Dudley, of Chicago (*Diseases of Women*, 1898), recommends an operation for anteflexion which has for its object, not only the curing of the endometritis, but also the complete correction of the deformity. Mann has had some experience with this operation, and has been entirely satisfied with the results, although his cases have not been numerous enough to enable him to speak with a great deal of positiveness. Dudley, however, recommends the operation, and it certainly accomplishes what he claims for it—namely, the complete rectification of the displacement.

Technique.—The operation is done as follows: The patient is placed in Sims's position, and the speculum is introduced under ether. The uterus is then dilated and curetted in the usual manner. The cervix is divided with scissors, backward in the median line, past the utero-vaginal attachment, nearly to the utero-peritoneal fold, in the pouch of Douglas (Fig. 381, Dudley).

"The cut surfaces thus incised are then held widely apart by means of two tenacula in the hands of an assistant; the incision is somewhat deepened by means of a scalpel, especially in the uterine wall next to the cervical canal, and a small angle is cut out on either side, as shown by the dotted lines in Fig. 382. The cut surface on each side is now folded on itself by a single silkworm gut suture, as shown in Fig. 382. This suture is tied and fortified by interrupted sutures on either side. The lines of union thus made are shown in Fig. 383.

"These sutures are not introduced in such a manner as to stitch the intracervical to the vaginal margin of the wound, but the cut surface is folded upon itself in a direction at right angles to this. On either side, that point at the margin of the os externum where the backward incision commenced is stitched to the very angle of the incision, so that each cut surface is folded upon itself, not from within outward, but from before backward. Thereby the os externum is carried directly back to the angle of the incision. The cervix now points backward in its normal direction toward the hollow of the sacrum, instead of forward toward the vaginal outlet (see Fig. 383).

"In some cases of extreme anteflexion, there is a disproportionately long anterior lip. This elongation is shown by the dotted line in Fig. 377. It is the result of a relatively greater pressure on the

posterior lip by the posterior vaginal wall; this lip should be caught with the tenaculum and partially removed by the scissors. The incised surface is then closed upon itself with sutures as shown in Fig. 384. The dotted line in Fig. 377 shows in section the line of incision through the protruding lip; the incision should extend to, but not into, the os externum. This part of the operation is not required unless the anterior lip decidedly protrudes, and is therefore usually omitted. The removal of a portion of the lip in a suitable case is not only not a mutilation, but it even contributes to the straightening of the uterus.

" Conjoined examination upon completion of the operation in each of the author's cases has invariably shown the uterus either to have been straightened or the anteflexion to have been reduced to a degree quite within physiological limits. The results have been substantially the same whether the point of flexure was at the os internum or below it.

" The two posterior lines of sutures have the effect of transplanting the os externum to the very angle of the posterior incision. The anterior sutures, if used, have the effect of carrying the cervix back by a distance equal to one half the length of the anterior cut surface, which is doubled upon itself. By these means a permanent change, quite equal to overcoming the flexure, is effected in the direction of the cervix. As the result of the anterior portion of the operation, the uterus in a suitable case is lifted also in a higher plane in the pelvis, where it ceases to be a mechanical irritant to the bladder. This portion of the operation may therefore be indicated for descent when complicated with anteflexion." (Dudley, *Diseases of Women*, p. 581, etc.)

This operation is not a substitute for dilatation and curetting, but rather supplementary thereto.

An operation called *cuneohysterectomy* has been devised for the cure of anteflexion. It is done by abdominal section and consists in removing a cuneiform piece of tissue from the convex side of the uterus at the point of angle. Its object is to straighten the anteflexed uterus by reducing to normal dimensions its elongated posterior wall. When done on the posterior wall it is called posterior cuneohysterectomy, and *vice versa*. The procedure was devised and practised by Thiriar in 1892. Reed did it for the first time in 1894. The details of the operation, as he has modified and now practises it, are as follows: The patient is prepared with the usual aseptic and other precautions for abdominal section. An incision about 12 centimetres in length is made in the median line and is carried as low as practicable with safety to the bladder. The patient is now placed in the Trendelenburg position. All adhesions between the uterus and bladder or between the uterus and other organs are carefully broken up, and rents in the serosa that may be induced thereby are carefully stitched. The uterus is then brought toward the incision by gentle but firm

traction and an ellipse of tissue about 1 centimetre wide, and having a length corresponding to the breath of the organ, is removed from the convex side of the site of flexure (Fig. 130). Care must be taken not to carry this dissection into the cavity of the uterus (Fig. 131), or to wound either the circular artery or the anastomosing branches of the uterine arteries. Should the latter accident occur, its result is best counteracted by ligatures *en masse* passed deeply into the uterine tissue at either end of the yet gaping ellipse. Retraction of the vessels generally prevents their isolation and closure by direct ligature which, when practicable, is always the preferable method. After all hemorrhage, except mere capillary oozing, is controlled, the margins of the ellipse should be carefully approximated and closed by an interrupted suture, or a continuous animal suture fortified with two or three interrupted ones of the same material. The uterus is then dropped back, and, after pausing a moment to make sure of complete hemostasis, the abdomen is closed without drainage. A further modification of this operation, and one which Reed has practised with satisfaction, consists in stitching a reef of the posterior folds of the broad ligament to either

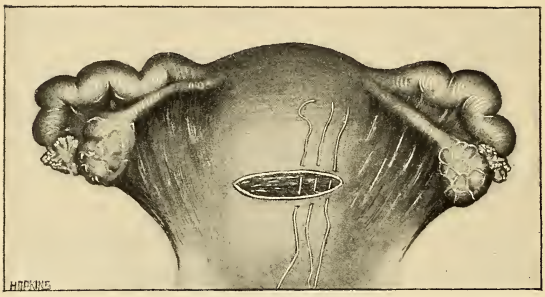

Fig. 130.—". . . an ellipse of tissue about one centimetre wide, and having a length corresponding to the breadth of the organ, is removed from the convex side at the site of flexure."—Reed.

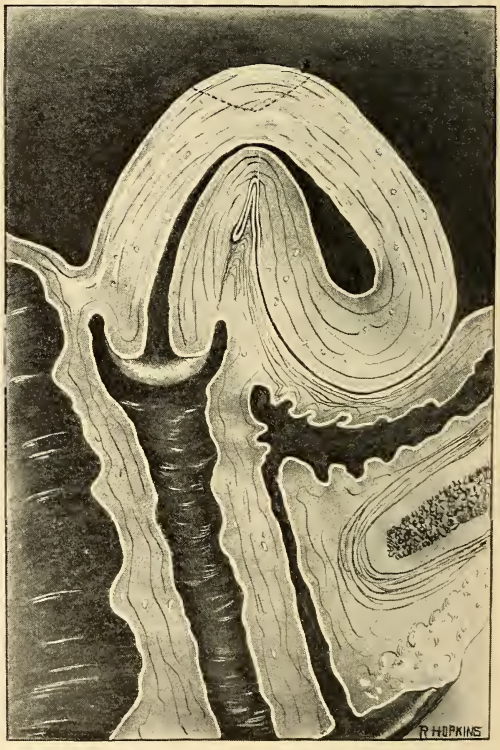

Fig. 131.—"Care must be taken not to carry this dissection into the cavity of the uterus."—Reed.

side of the posterior surface of the uterus (Fig. 132). The utero-sacral ligaments, if found contracted, are nicked and stretched. He has been able by these combined methods to relieve the most distressing and persistent symptoms, vesical, uterine, ovarian, and neurotic, due to otherwise intractable anteflexion of the womb.

Fig. 132.—"A further modification . . . consists in stitching a reef of the posterior folds of the broad ligament to either side of the posterior surface of the uterus."—Reed.

Prolapsus Uteri.—*Prolapsus* is that anomaly of position of the uterus in which the organ has shifted from its normal site, has descended or fallen to a lower level, and projects partly or completely outside of the vulva (Fig. 133). According to the degree of the descent we distinguish between partial or total prolapse. There is only a difference in degree between these varieties, their entire etiology

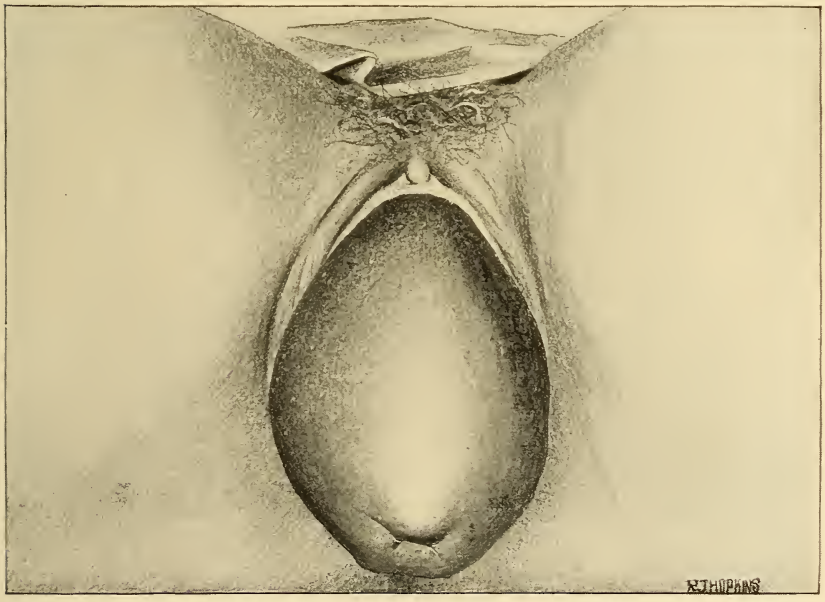

Fig. 133.—"Prolapsus is that anomaly of position in which the uterus projects partly or completely outside the vulva."—Herzog.

being the same, and they do not call for a separate consideration. Partial prolapse is frequently spoken of as *descensus uteri*; the term prolapsus is then reserved for the total prolapse.

Prolapsus uteri is almost invariably an acquired condition, though there have been reported by Ballantyne and Thomson, Heil, Krause, and Remy and Quisling, a few cases of congenital prolapse. These cases were always found in connection with other congenital anomalies. A condition simulating partial prolapse, which, however, anatomically, as well as from an etiological point of view, is entirely different from the morbid condition under discussion, is that of primary hypertrophy of the portio vaginalis uteri. This anomaly is always congenital, and it may and does secondarily lead to a true prolapse.

There exists still a good deal of controversy as to the *etiology and mechanism* of prolapsus. A view formerly held almost universally, and still adhered to by some, is that the primary factor in the production of a prolapse of the uterus is the prolapse of the vagina. The latter again is traced back to a subinvolution during the puerperium. This opinion is contested by Küstner, who has studied the subject extensively and who very clearly and forcibly elaborates his observations and views in a most excellent treatise (Veit's *Handbuch der Gynäkologie*, Wiesbaden, 1897, vol. i, p. 168). This author holds that it is impossible that a uterus normal in position can be forced out of the pelvis into the vagina. As long as the uterus is in its normal antero-versio-flexio position abdominal pressure acts upon its posterior wall and presses the body upon the bladder. The portio vaginalis under increased abdominal pressure has a tendency to rise, if anything. When, however, the uterus is in a retroverted-retroflexed position its vaginal portion becomes dislocated in the direction of the symphysis pubis and moves at the same time nearer the pelvic outlet. The uterus and its cervix now lie so that their axis has the same direction with, or forms the continuation of, the axis of the vagina. Increased intra-abdominal pressure can now easily force down the uterus into the vagina, this being made still easier since in retro-versio-flexio the vaginal portion of the cervix is nearer the pelvic outlet than under normal conditions. It is quite common that a history of retro-versio-flexio can be obtained in cases of prolapsus. The reason this condition is most frequently found among women in the lower walks of life is easily explained. Women of the better classes, as a rule, when retro-versio-flexio leads to any symptoms, seek medical aid and receive the proper attention. Women who have to work hard for a living often find no time to consult the physician, and, even if they do, they can not submit to the proper treatment and regimen to correct the retro-versio-flexio. If this goes on uncorrected and the woman suffering from it is performing hard physical work, the constant exertions, and the persistent abdominal strain in consequence thereof, will, in a large percentage of cases, force down the uterus and produce descensus and prolapsus. There are also some cases, however, in which the causation of the affection may be different. If, after childbirth, the vulva remains gaping for too long a time, there may occur a prolapse of the anterior vaginal

wall, even if the uterus is not in retro-versio-flexio, and this may be followed by prolapse induced by the persistent traction upon the uterus and its ligaments. Prolapse may be preceded and caused by extensive untreated perineal lacerations, the mechanism of causation being the same as just indicated. Another set of conditions which may bring about prolapse is senile changes of the genitalia, accompanied by atrophy of muscular, and disappearance of adipose, tissue. A factor which may greatly hasten the establishment of an extensive prolapse, if the other conditions are favourable, is great increase in the intra-abdominal pressure in consequence of large pelvic tumours or ascitic accumulations. In prolapse of the uterus there is, of course, present a prolapse of the vagina. The upper part of the latter is either invaginated into the lower part, or the whole of the vagina lies inverted in front of the vulva. Total prolapsus uteri, however, does not always mean total prolapse of the vagina, and *vice versa*. Combined with the uterine prolapse, there is present a displacement of the bladder (cystocele), and of the urethra. Rectocele may be present but is usually absent.

The *pathologic changes* are various. That such a malposition, such a complete change of conditions as is found in prolapsus uteri, is accompanied by grave and profound anatomical lesions, is self-evident, though of course some of the pathologic changes precede instead of follow descensus. Very marked are the changes of the lining of the inverted vagina. The epithelia become dry and horny. In some places the epithelial covering is thickened, while in others, particularly in the neighbourhood of the external os of the cervix, it becomes thinned out and is entirely lost, so that ulcerations appear in this neighbourhood. These changes are due to the fact that the inverted vagina is no longer moistened by the cervical secretion but is exposed to the air and subjected to other insults. The ulcerations frequently show sharp margins, or they present clefts caused by traction upon the changed tissues. There is generally noticeable a hypertrophy of the prolapsed parts. It is most marked at the portio vaginalis uteri, but is also well seen in the supravaginal portion. The cervix as a whole is often greatly elongated and thickened in its antero-posterior and lateral diameters (Fig. 134). The uterine body is likewise enlarged, though proportionately to a lesser degree. In women advanced in years, the enlargement of the corpus may be very insignificant or even absent. The enlargement of the uterus is, however, not so much due to a true hypertrophy as to an extensive œdema caused by circulatory disturbances. That this is indeed the case, is proved by the observation that after reposition of the organ, its size is often materially decreased in a very short time. The mucous membrane of the uterus in prolapse is thick and succulent, and there occurs not infrequently an endometritis glandularis hypertrophica. The higher degrees of prolapse being usually combined with prolapse of the bladder, this organ likewise shows morbid changes, such as catarrhal inflam-

mation of the vesical mucous membrane, or inflammation of the muscular coat which may even lead to destructive processes. The vesical inflammation may spread by continuity to the ureters and the pelves of the kidneys. Küstner in a case of prolapsus uteri saw a profound purulent pyelitis which ran a fatal course. Inflammatory changes of the internal sexual organs, the tubes and ovaries, and the pelvic peritoneum, are quite frequent in prolapse. Küstner, in a series of eighty cases of laparotomies, ventrofixations, and plastic operations on the vagina for prolapse, carefully examined the internal sexual organs and found that in almost one half of them chronic inflammatory processes could be observed in the ovaries, the pelvic peritoneum, and the fimbriated extremities of the Fallopian tubes. The pathologic conditions found were oöphoritis corticalis, hydrops folliculorum ovarii, perimetritis, perisalpingitis with or without closure of the abdominal end of the tube, and hydrops of the tubes. The same author frequently noticed a mild degree of serous infiltration of the pelvic peritoneum. In some of his fatal cases of prolapse he saw, in consequence of profound septic infection due to streptococci, abscess formation in the subperitoneal connective tissue, particularly in the connective tissue between the bladder and uterus. Also purulent infiltration of the muscular coat of the uterus, abscess of the ovary and

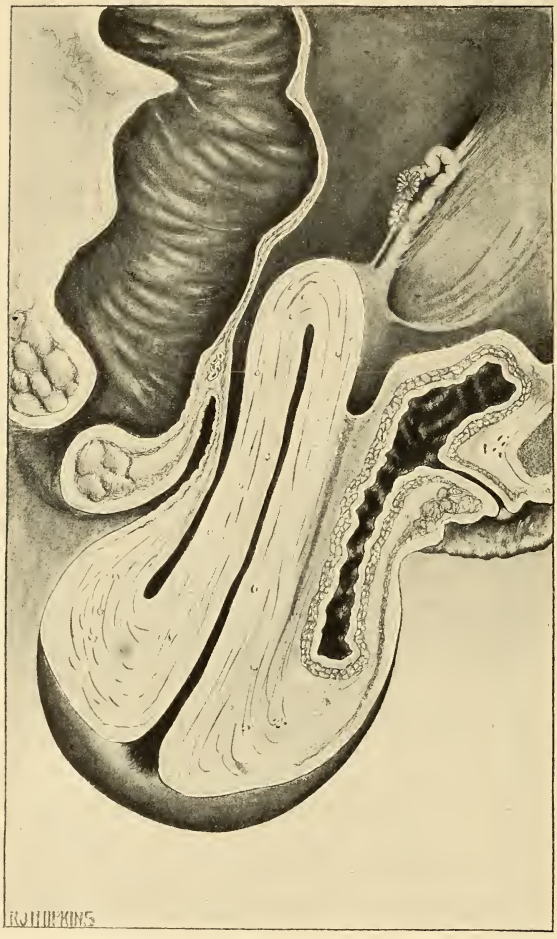

Fig. 134 (Martin).—"The cervix as a whole is often greatly elongated and thickened in its antero-posterior and lateral diameters."—Herzog (page 319).

encapsulated or general purulent peritonitis. (See Pathology of Uterine Displacements.)

The *symptoms* of prolapsus uteri may be so mild in the earlier stages as easily to escape attention, or, if detected, they are liable to be interpreted as indicating a less important condition than a displacement of the uterus. Pain in the loins, sacralgia, increased by walking, prolonged standing or overhead work, and, particularly by straining at defecation, is the first to attract attention. This pain increases as the condition advances until the patient becomes conscious of what she construes to be a foreign body in the vagina. Pressure by the descending organ is liable to cause vesical and rectal tenesmus. In a still further stage of development the cervix presents at the ostium vaginæ, or the entire uterus may protrude externally and occupy a position between the thighs. The diagnosis in the earlier stages is not always easily made. Patients are generally examined in either the recumbent or the semiprone (Sims's) position—in either of which, but particularly in the latter, a uterus in the earlier stages of descent has a tendency to gravitate into its normal situation. It occasionally happens that the first suggestion of an existing prolapse is derived from the fact that a well-adjusted tampon is being unaccountably extruded from the vagina. This fact will prompt an examination of the patient in the standing posture—provided that this has not already been done, as a part of the earlier examination of the case. The uterus will be found to have descended from its normal plane and to occupy a position of relative retroversion. It may be found in any degree of descent. Complete procidentia may be mistaken by the patient herself for cystocele and hydrocele, but this point is easily cleared up by careful examination. A uterine polypus, or even one of vaginal origin, may simulate complete procidentia uteri. The diagnosis is cleared up under these circumstances by careful digital examination, with particular reference to detecting the location and condition of the cervix. Bimanual exploration, by determining the location of the fundus and the size of the uterus, will clear up any remaining doubts. Inversion has been mistaken for prolapsus of the uterus, but the history of the case, the existence of the hemorrhage, the character of the mucosa, and the existence or nonexistence of the fundus in its normal relations as determined by bimanual examination, will lead to an accurate conclusion.

Treatment.—*Conservative*, or, more properly speaking, the nonsurgical treatment of these cases, resolves itself into medicinal, hygienic, and mechanical. The *medicinal treatment* consists, for the most part, in the administration of laxatives to overcome the constipation, which, in many cases, is a potent factor in the causation of the trouble. For this purpose saline waters, such as the Hunyadi János or the Apenta, should be given persistently in comparatively small doses after, but not before, meals. If given before meals, they will cause catharsis, enervation of the bowels, and consequent aggravation of the constipation;

but if given after meals they will mingle with the food, and, after a couple of days, induce normal dejections not followed by serious consequences. *Hygienic measures* consist in attention to all the secretory functions, and especially avoidance of errors in diet. Massage of the uterus has been recommended, and as a remedy for relieving passive engorgement or chronic hyperplasia it is of value, and should be employed for the relief of prolapse, especially in its incipiency, whenever dependent upon these conditions. It should not, however, be employed in the presence of acute inflammation of either the uterus or its appendages. Under the head of *mechanical treatment* tamponade must be given first place. This should be practised as elsewhere described in this volume. If tampons saturated with some astringent agent are carefully adjusted they will give excellent mechanical support and afford the relaxed ligaments an opportunity to regain their strength. Pessaries are employed for the same purpose and a certain percentage of cures is realized from their employment, which, however, is not destitute of danger. The pessary with an intrauterine stem should never be employed; cup-pessaries are for the most part mischievous in their results, and, to avoid their damaging influence, must be frequently removed. The martingale ring of hard rubber may keep the uterus within the pelvis, but it does so by distending the vagina laterally and by resting upon the pelvic floor. The inflated soft-rubber pessary has an even better power of retention, but it is, at best, a dirty and stinking thing, and should be used only when other means of treatment are not available. This instrument is very popular with practitioners because of the facility with which it is placed and the effectiveness with which it keeps the womb from dropping out of the vulvar orifice. The fact, however, is generally lost sight of, that this pessary never cures prolapsus in the sense of restoring the uterus to its normal position and keeping it there, and but few practitioners take into account the other fact, namely, that by a continuous pressure upon the pelvic floor and by persistent lateral distention of the vagina, this instrument has a tendency really to aggravate pre-existing troubles, notwithstanding the fact that it affords temporary relief. The soft-rubber pessary favours germ propagation and is, therefore, a constant menace to the health. The best device among pessaries is Thomas's retroversion pessary already alluded to. If carefully adjusted, it affords comfort in these cases and its use is sometimes followed by cure.

The *surgical treatment* of downward displacements of the uterus has for its object the return of the organ to its natural position and its retention there by the restoration, so far as possible, of its normal anatomic connections. Any treatment, to be effective, must be carried out in full recognition of the fact, that prolapse of the uterus commonly occurs as the result of either serious lacerations of the pelvic floor and the perineum, or as the result of atrophy and relaxation of all the uterine supports. The final result is the same in each case. In a

limited number of cases, the injuries below are not so much the cause of the prolapse as the great relaxation of the uterine ligaments, particularly the utero-sacral. No prolapse can take place without relaxation of these ligaments.

The first step in a prolapse is always a retroversion; so that relaxation of the round ligaments is a universal accompaniment of this condition. If, with the relaxation of the round ligaments, there is also relaxation of the utero-sacral ligaments, then the uterus, following the axis of the pelvis, slowly and gradually makes its way downward under the influence of intra-abdominal pressure, until it finally appears at the vulvar orifice, and may eventually be forced outside the patient's body. These being the causes of prolapse, all operative procedures must have for their object the restoration of the normal supports of the body. If these can not be restored, then some new support must be sought. With the object of relieving the downward traction on the uterus, operations may be performed on both the anterior and posterior vaginal walls. Unquestionably, the best operations for this purpose are those devised by Sims and Emmet.

Emmet's Operation upon the Anterior Vaginal Wall (Anterior Colporrhaphy).—" I first antevert the uterus with my finger, as the patient lies on the back. The neck of the uterus is then kept crowded up into the posterior cul-de-sac by a sponge probang in the hands of an assistant, while the patient is being placed on the left side for the introduction of the speculum. I then endeavour to find two points, one about half an inch from the cervix on each side, and a little behind the line of its anterior lip, which can be drawn together in front of the uterus by means of a tenaculum in each hand. When two such points can be thus brought together without undue tension, forming triangular-shaped folds, the surfaces are to be freshened. One of the tenacula must be securely hooked in the tissues, to indicate the point. Then, one hand being disengaged, a surface half an inch square about the point of the other tenaculum is to be denuded with a pair of scissors. Next a similar surface is to be freshened around the point of the first tenaculum, and a strip afterward removed from the vaginal surface, in front of the uterus, about an inch long by half an inch wide." (Emmet's *Gynecology*, third edition.)

A ligature of catgut is then passed beneath each of these freshened surfaces, which, when tied, brings them all together in front of the cervix, with the effect of forming a fold at this point. There are also, upon the anterior vaginal wall, two folds in the shape of an ellipse, extending from the surfaces secured in front of the uterus, nearly to the vaginal outlet. These folds are now to be denuded, turned in, and secured with a continuous catgut suture. The stitches should be placed about a quarter of an inch apart, and should include a liberal amount of tissues. The patient should be confined in a recumbent position for two or three weeks after the operation, until the parts are firmly united.

Following this operation, or at the same sitting if thought advisable, the perineum should be firmly closed by Emmet's method. (See Chapter on Rupture of the Perineum.)

The cervix uteri, if lacerated or diseased, should be closed by the operation of trachelorrhaphy, or amputated, as the case may be.

It is Mann's belief that these operations alone will not generally cure permanently a bad case of prolapse. As the uterus is always retroverted in this condition, if it is left turned back it will remain in the axis of the vagina, and, acting as a wedge, will gradually force its way down and out, and the old conditions will be reproduced. To obviate this condition, it will be necessary to restore the round ligaments and the utero-sacral ligaments. In this way the cervix can be kept up in the hollow of the sacrum and the fundus turned forward. If this is done, the uterus will be at nearly right angles to the vagina, and the danger of a return of the prolapse will be done away with.

After the operations upon the vaginal outlet the patient may wear a pessary, which takes the place of the utero-sacral ligaments, and this in itself may be enough. If not, then Alexander's operation may be done and the fundus kept forward by the tightened round ligaments. All idea of curing a prolapse by doing Alexander's operation must be laid aside, as the round ligaments alone are not strong enough to suspend the uterus, but, in a very short time, will give way and allow a relapse. In very bad cases where the uterus is greatly enlarged, and in old women, in whom very great atrophy of the parts has taken place, all these procedures are apt to fail, and we must then resort to ventral fixation, as already suggested.

The removal of the uterus for the cure of prolapse, in the opinion of Mann and other representative gynecologists, is wrong. It is not, in his view, the weight of the uterus merely which brings it down, but the relaxation of the supporting structures. After the uterus is removed, the vaginal walls will come down as badly as ever, and Mann has seen one case at least in which hysterectomy failed to cure, the previously existing rectocele and cystocele recurring and becoming worse, until a complete hernia of the vagina existed. The cure of this condition is exceedingly difficult, and is harder than before removal of the uterus, as the possibility of ventral fixation is done away with.

Inversion of the Uterus.—Inversion of the uterus means a turning inside out of that organ, and consists of the invagination of the fundus into or through the cavity of the womb. This form of displacement is not frequent; Braun and Spaeth report that not a case of complete inversion of the uterus has occurred in 250,000 births in their clinics; while it has been observed but once in 191,000 deliveries in the Rotunda Lying-in-Hospital of Dublin.

The *causes* of inversion of the uterus are generally, but not always, connected with parturition. At this time, when the uterus is enlarged and its walls are softened by the ordinary evolutional changes of pregnancy, but two additional conditions are required to render inversion

probable, viz.: relaxation of the uterine wall and downward traction upon the fundus. This traction may be exercised by drawing upon the cord in a case of fundal implantation of the placenta; or, given a case of adherent fundal placenta, the involuntary efforts of the uterus to expel the afterbirth, may cause the latter to drag the fundus downward into the cavity, or, for that matter, through the open cervix into the vagina. A large pedunculated polypus attached to the fundus of the uterus and finally expelled by that organ may, by persistent traction, induce inversion in the nonpregnant uterus. A case of this kind came under the observation of Reed. Small sessile fibroids have been found in the wall of the inverted uterus and have been construed as causes of the condition. The mechanism of inversion in these cases has been explained by Treub, who states (*British Gynecological Journal*) that in them there " is no regular contraction of the uterine wall and that there can not be. The base of a sessile tumour can not contract, because of the implantation of the tumour, which diminishes or altogether abolishes the contractility of that part of the wall, and it can not be that only the contractility of that base is diminished; the surrounding parts must necessarily be feebler within a greater or smaller circumference. If from the outset the tumour was intramural, the smaller degree of resistance of that part of the uterine wall, coupled with intra-abdominal pressure, may occasionally bring about a slight beginning of inversion. And when this is the case, the conditions are essentially the same for sessile and intramural tumours, and for the partial inversion described by Rokitansky. A circle of uterine tissue is abruptly curved in the place where Rokitansky found the external indentation. I need hardly say that in that incurved circle the uterine muscle must be absolutely paralyzed. And this paralysis again will not be confined to a linear circle, but gradually diminishing will extend over a greater or smaller surface. The contractions of the normal part of the uterine wall will try to expel the part of the wall that acts as a foreign body. These expulsive efforts may slightly increase the inversion as far as the paralysis surrounding the circle of inversion permits, thus displacing the circle itself; and paralyzing another part of the uterine wall. Necessarily the extension of the partial paralysis proceeds farther in the uterine wall, too, and by the repeated action of this muscular play the inversion may gradually become complete as regards the body of the uterus. As soon as the body is inverted, there is no longer any excitement for uterine contractions, and the inversion of the cervix generally does not take place. And it is the intra-abdominal pressure again that may invert the cervix too."

Inversion of the uterus may be complete or incomplete; in the former case the organ is turned completely inside out, the inverted fundus and body of the uterus lying within the vagina (Fig. 135), or protruding from the vulvar orifice. The condition may also be described as recent or old, acute or chronic, the one type being represented by the recent inversion of the organ with its attendant alarming symptoms; the

other, when the condition either complete or incomplete has occurred, involution of the uterus having taken place after the occurrence of the displacement, which remains in a chronic and more or less permanent form.

The *symptoms* of inversion of the uterus following parturition consist, first, in profuse hemorrhage ensuing upon the delivery of the placenta; or, when the fundus is drawn down by the still adhering placenta the latter may be peeled off by external action, and violent hemorrhage ensue. Physical examination should be made at once by the bimanual method. The intra-vaginal finger will detect a globular mass, presenting either just without or just within the thoroughly relaxed cervix; while the hand upon the abdominal wall will readily detect the disappearance of the fundus from its normal site with the development of a distinct ring at the point of its disappearance. In an interesting case reported by Cordier wherein an inversion had followed an operation for the removal of a polypus, the symptoms during the next few months were those of frequent yet slight discharge of blood-stained fluid from the vagina; there were no menstrual pains, nor was there a history of extrusive contractions of the uterus. Digital examination revealed in the vagina a pyriform mass about 3 inches in length by 2.5 in breadth, of a soft and velvety nature, and not painful to the touch. The finger could be carried all round the mass, which disappeared through the os by a constricted neck, and could be swept around the neck of the mass for nearly an inch within the cervical canal. The speculum revealed the openings of the Fallopian tubes, on the presenting aspect of the mass. A probe could be easily introduced into the uterine ends of the tubes under vision while the speculum was in position. Such appearances as the foregoing, coupled with the disappearance of the fundus from its normal situa-

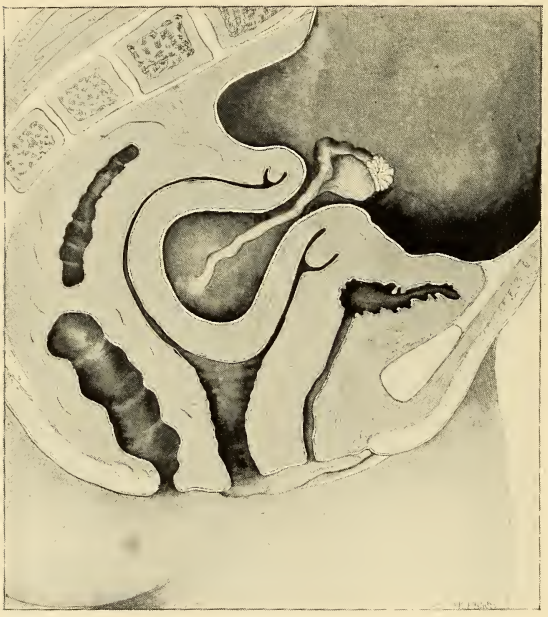

Fig. 135.—"Inversion of the uterus may be complete . . . the . . . fundus and body . . . lying within the vagina." —Reed (page 325).

tion, as determined by bimanual exploration, comprise the essential diagnostic criteria in these cases.

If the abdominal wall is thick, and the condition of the uterus, particularly in nonparturient or in chronic cases, can not be outlined by the bimanual manipulation, the index finger of one hand should be introduced into the rectum while a sound is passed into the bladder; if the sound and the finger meet above the presenting tumour the evidence is conclusive that inversion exists.

The *prognosis* of inversion of the uterus is never favourable, although A. F. Jones, of Omaha, reports a case of spontaneous reduction of an inverted uterus three years after the occurrence of the accident. Crosse studied the histories of nearly 400 cases, with the result that he ascertained the mortality from this condition to be nearly 35 per cent, death occurring either very soon after the accident or within a month. Of 109 fatal cases, the fatal termination in 72 ensued within a few hours, and in the majority within half an hour. Eight died in from one to seven days and six in from one to four weeks. After the first month the danger is slight, but it begins again with the resumption of menstruation, which has a tendency to become hemorrhagic. Crampton's table (*American Journal of Obstetrics*, October, 1885) reveals the fact that of 120 recent cases, 87 recovered, 32 died, 1 remained unrelieved. Twelve of the cases, however, were moribund when first visited. In the fatal cases, reposition was usually effected readily enough, but too late to save life. Of 104 chronic inversions, 91 recovered, 7 died, and 6 remained unrelieved. The average mortality as shown by Crampton's table is about 20 per cent. Pregnancy may occur, followed by normal delivery, in cases in which the uterus has been inverted and has either reduced itself spontaneously or has been reduced by operation.

The *pathology* of this condition is by no means distinct. When the accident occurs in the puerperal state the probably one essential factor in its causation is uterine inertia, which is a functional rather than an organic condition. After the occurrence of puerperal inversion, the womb, if left in position, seems to undergo the ordinary course of involution. Aside from the malposition there seems to be no special pathologic state induced. Treub, of Amsterdam, made a careful microscopic examination of a uterus which he removed for nonparturient inversion, and found the muscular structure normal with absolutely no appearance of atrophy. There existed, however, a very œdematous hypertrophy of the exposed mucous membrane.

The *treatment* of inversion of the uterus differs materially in acute and in chronic cases. *In acute cases*—i. e., those of recent occurrence—the first indications are to secure hemostasis and to effect reduction. The hand should be immediately inserted into the vagina and upward pressure should be exercised by the fingers directly against the centre of the protruding mass, while counter pressure should be exercised from above by a hand placed against what may now be designated as the

cervical ring. It is better to conduct the intravaginal manipulations under a current of water heated to 110° F., or, preferably, water and vinegar, half and half, brought to the same temperature. Vinegar is an excellent hemostatic with distinct antiseptic properties. If the fountain syringe or other reservoir is hung very high, the hydrostatic pressure thereby secured becomes an additional force available in the work of reduction. If these measures do not at once control the hemorrhage, and if its continuance for any length of time is a menace to the patient's life, an elastic band should be placed around the neck of the protruding mass and should be left *in situ* for several hours. It should not be adjusted so tightly as to induce strangulation, nor should it be left on so long as to produce destruction of the tissue. When it is unwound the hemorrhage will generally be found to have ceased, in which case manipulations looking to the reduction of the organ should be resumed. Mechanical repositors, consisting of a staff with a bulbous extremity, may be made from wood or other material and used with persistent pressure. Lawson Tait utilized constant elastic pressure, which he applied to a repositor by means of an elastic perineal belt fastened before and behind to an abdominal girdle. There are some dangers attached to this method of treatment. If the intrauterine extremity of the repositor is not very blunt, or else bulbous or cup-shaped, an apparently slight elastic pressure may be sufficient to force it through the soft uterine tissues. Then, too, if the repositor with a large bulb, or a cuplike intrauterine end, succeeds in accomplishing its purpose, the instrument itself may become incarcerated by contraction of the cervix. While this complication is by no means insurmountable, it has proved embarrassing. If the extemporized repositor is made of wood or other porous material, it may speedily become septic and a consequent source of extreme danger. To avoid this accident, it should, if conveniently possible, be given two or three coats of shellac before being used.

The treatment of *chronic inversion* of the uterus has been a source of great perplexity since the days of Hippocrates. This master genius described with great fidelity the condition of inversion, which he treated by placing the woman on her back, upon a couch, elevating her feet, extending her legs, and applying compresses and sponges against the tumour, holding them in place by means of a perineal bandage. This was kept up for seven days. If it failed, the woman's womb was anointed, she was fastened by her heels to a ladder with her head hanging down, and was violently shaken with the object of thus reducing the displaced organ. Strange as it may seem, Castex, as late as 1859 (*Gazette hebdomadaire de médecine et de chirurgie*), reported the successful adoption of this Hippocratic practice by a Moorish midwife at Tangier. The condition and its treatment through the succeeding centuries commanded the attention of Rhazas, Avicenna, Aretæus, and Themison, among the ancients.

Various modern methods have been devised to effect the reduction

of chronic inversion of the uterus. White, of Buffalo, as long ago as 1858, published a plan of reduction by continued pressure, which he applied by adjusting the soft rubber cup-shaped end of a repositor against the presenting fundus of the uterus; to the other end of this repositor a spring capable of maintaining ten pounds pressure was adjusted, and so arranged as to lie against the breast of the operator. Pressure was thus exerted, while counter-pressure was made by the hands against the cervical ring, the pressure being exercised through the abdominal wall. This method was modified by Tyler Smith, Aveling, Wing, Robert Barnes, Lawson Tait, and others, but with no essential deviation in principle.

Carl Braun, in 1851, introduced a method of reduction by vaginal tamponade by means of a caoutchouc bag which he called a colpeurynter. When this bag is properly adjusted to the uterus, the latter is pressed upward in such a way as to place the vaginal attachments upon the stretch, causing them to draw open the cervical cavity by lateral tension, thus acting not only as a dilator but as a repositor. The same principle is applied to-day by many practitioners. Neugebauer utilizes an intravaginal elastic bag which is gradually distended with water from a high plane. The hydrostatic pressure thus induced is found to be effective, a case in which the inversion had existed for two years having been thus reduced in nineteen days. The patient suffered no pain and learned to fill and empty the bag herself when it was necessary to relieve the pressure upon the urethra.

When conservative means at reduction fail, recourse must be had to surgical intervention. T. Gaillard Thomas advised an operation of forcible dilatation of the inverted uterine canal. This was practised by first making an abdominal section, stretching the uterine tissues by means of a strong uterine dilator, and then reducing the uterus by conjoined manipulation. The mortality following this operation was large and it has been practically abandoned. The principle involved in Gaillard Thomas's operation, viz., the forcible dilatation of the inverted uterine canal, has been so modified as to avoid the necessity of the preliminary abdominal section. This modification consists in drawing down the uterus carefully enveloped about its neck with some sterilized gauze. An incision is then made through either the anterior or the posterior uterine wall, and through this incision a dilator is introduced. When the dilatation has been carried to a sufficient degree, as determined by the introduction of the finger through the operation wound and through the now dilated cervical canal, the incision is sewn up with sterilized catgut and the fundus is forced back into position. Kehrer (*Centralblatt für Gynäkologie*) draws the inverted uterus down to the entrance of the vagina and makes an incision on its anterior surface through the whole length of the cervix from the os externum to a little beyond the middle of the corpus, and extending directly through into the peritoneal cavity. The wound is then stitched from the fundus to the os internum, after which the

inversion is reduced, when, finally, the lower part of the wound is sewn up as far as the os externum.

Hirst operates by dividing the posterior cervical wall as far up as may be necessary to gain space through which to effect the reduction, which he has been able to do without making the extensive incision of Kehrer. After the uterus has been restored by Hirst's method, the only remaining step consists in applying a few interrupted sutures to the incised posterior lip. This operation impresses one as being at once simple and effective.

Vaginal hysterectomy as a remedy for chronic and irreducible inversion of the uterus is not a modern conception. Themison suggested it B. C. 50, but it was not adopted in practice until Soranus, of Ephesus, amputated an inverted uterus about the end of the second century of our era. The suggestion has been recognised as one of practicability from that day until the present. In its adoption the general principles of technique should be observed that are outlined in the chapter on vaginal hysterectomy.

In view of the fact that the inverted uterus, when once restored, is capable of exercising the functions of reproduction, vaginal hysterectomy should not be performed in child-bearing women.

CHAPTER XXV

INJURIES OF, AND FOREIGN BODIES IN, THE UTERUS

Injuries: (*a*) parturient; rupture, laceration of the cervix—Trachelorrhaphy (Emmet)—Amputation of the cervix—(*b*) nonparturient; wounds from external causes—Foreign bodies.

Injuries of the uterus divide themselves naturally into (*a*) parturient, and (*b*) nonparturient.

Rupture of the uterus is an accident of parturition. It may be complete or incomplete. In the latter, the injury is restricted to the muscularis while the peritoneum remains intact. This was regarded by Lusk as more likely to occur in lateral tears at the site of the folds of the broad ligament—though, owing to the relatively loose attachment of the peritoneum at the lower segment, incomplete ruptures are not necessarily confined to those points. In the complete form the tear extends through the muscularis and the peritoneum, making, usually, a communicating wound with the abdominal cavity, although lacerations have occurred in that zone of the uterus which lies in normal attachment to the bladder.

The *causes* of rupture of the uterus may be summarized by saying that they may consist of any condition that interferes with the descent of the child, that favours the ascent of the body and fundus, or diminishes the normal powers of resistance of the uterine walls. A monstrosity, a hydrocephalic head, neglected shoulder presentation, are examples of causes that may exist in the fœtus. Fibroid tumours, distortion of the pelvis, and malignant disease of the cervix, are among the maternal causes. Some writers have placed emphasis upon fatty degeneration of the uterine parenchyma as a demonstrated cause of this condition.

The mechanism by which uterine ruptures are caused was first satisfactorily explained by Bandl. He explained that in normal labour the contractions of the uterus resulted in a thickening of the fundus and body, while the lower segment was stretched and thinned by the downward pressure exercised by the presenting part of the fœtus. This process was strictly physiologic, so long as no obstacle existed to interfere with the descent of the child. The natural result of this dilatation was the practical conversion of the uterus and vagina into a continuous canal. When labour was advanced, the lower circumference of the body of the uterus was ordinarily distinguished from

the stretched lower segment by the ridge induced by the contractions, and now known as the ring of Bandl. This ring was ordinarily found in the neighbourhood of the pelvic brim, but its development was proportionate to the difficulty of the labour. In the presence of some obstruction to the normal descent of the child, the retentive force exercised by the suspensory ligaments of the uterus resulted in the upward retraction of the fundus and body of that organ. This upward migration of the superior zone of the uterus resulted in a corresponding upward migration of the contraction ring, or the ring of Bandl. The ascent of this ring deprived the lower segment of the uterus of those accessions to its volume and resistant force, which, under normal circumstances, would be derived from the natural dilatation of the ring of Bandl. As a consequence, the lower, or cervical, structures became stretched and thin, often to a degree that they could no longer maintain their integrity against the expulsive and divulsive force from within. In this way, according to Bandl's explanation, the majority of all ruptures of the uterus begin in the lower segment, a philosophic conclusion which is amply confirmed by clinical observation. The view has been urged that, while ruptures of the uterus, for the reasons already given, generally begin in the lower segment and extend upward, their further extension toward the fundus is arrested by the action of the now migrated ring of Bandl, which, in certain cases, may be felt through the abdominal walls above the pubis, or, even as high as the umbilicus. Many of the ruptures reported, indicate that a tear probably started in the lower segment of the uterus, and extending upward part way to the fundus, had been deflected to one side or the other. This was manifested in two cases by Reed. (*New York Medical Journal*, November 9, 1889.)

The *symptoms* of rupture of the uterus, when partial, may consist of only an evanescent and not severe shock, a temporary interruption of the pains, and a persistence of hemorrhage after delivery. When the rupture is complete, however, the phenomena induced by the accident are striking and unmistakable. There is profound shock; the uterine contractions and pain cease instantly; the presenting part of the child recedes; the fundus of the uterus tilts to one side, or entirely disappears in the presence of a new, strange, and indefinite tumefaction within the abdomen; a bloody discharge makes its appearance; and frequently there is prolapse of the funis. A careful examination at this time will indicate, not only a recession of the presenting part of the child, but an apparent atony of the cervical structures. If the child has escaped into the abdominal cavity, the hand is introduced without difficulty into the uterus, and may, in certain cases, be carried through the rent in the uterus into the peritoneal cavity. The diagnosis, according to Ludwig, is not always easy, even when the foregoing symptoms are taken into account. He has found the best diagnostic sign to be, (*a*) in lateral rupture, the interruption of the natural contour of the uterine quadrant, when either a projection or a nodule

is formed; (*b*) suddenly acquired abnormal mobility of the uterus; and (*c*), a sign upon which he places great emphasis, viz., emphysematous crackling at the seat of rupture. If the head presents and can be pushed back, the bimanual examination under deep narcosis makes the diagnosis certain.

The *treatment* of rupture of the uterus is to be directed to the saving of the life of both the mother and child, when possible. If the child is yet within the uterine cavity, the vertex presenting, forceps should be applied without delay; if breech or shoulder is presenting and the child is known to be alive, version may be practised. If the child is still within the uterine cavity but is known to be dead, it may be delivered by craniotomy, *morcellement*, or by any other means that will most speedily empty the uterine cavity. After delivery the uterine cavity should be carefully explored, and, if the rupture is found to communicate with the peritoneal cavity, an abdominal section should be done at once. If rupture has been complete and has been followed by the escape of the child into the peritoneal cavity, the child should be delivered by abdominal section. The same course is to be followed when the child has been delivered *per vias naturales*, and the placenta has escaped into the abdominal cavity—indeed it may be adopted as a safe rule that the abdominal cavity should be opened whenever rupture of the uterus can be demonstrated to be complete, no matter what may or may not have passed through the rent. This conclusion is based upon the fact that although neither the child nor the placenta may have escaped into the abdominal cavity, complete rupture could not occur without the escape into the peritoneal cavity of either blood, amniotic fluid, or other products of gestation, liable to be either the bearers or the sources of infection. The abdomen should in such cases be opened and thoroughly washed out with normal salt solution. If hemorrhage is in progress, it should be controlled either by the application of forceps to the broad ligaments, far enough down to control, not only the ovarian, but the uterine arteries; or by an elastic ligature temporarily applied below the site of rupture. The treatment of the uterus at this point is one of extreme importance. The rent may be closed, which is best done by paring the edges, and approximating and closing them by the seroserous suture, adopted by Czerny and Lembert, in Cæsarean section (see Cæsarean Section); or the uterus may be removed, converting the procedure essentially into a Porro operation. Unless there is extensive destruction of the tissues of the uterus, with obvious infection, its removal is not justifiable. Women who have sustained rupture of the uterus and who have been successfully operated upon by closure of the tear, have subsequently borne children. Deutsch (*Centralblatt für Gynäkologie*, November 14, 1889) reported a case of symmetrically contracted pelvis in which rupture of the uterus had been treated by abdominal section four years previously. The patient went to term, when examination revealed the uterus adherent to the abdominal wall, causing a marked projection

of the abdomen. The fœtus being found to be living, the patient was *narcotized*, the os was dilated, and a living child was delivered by podalic version. If carcinoma or fibroids are either the underlying cause or the associated condition of a rupture of the uterus, no hesitancy about its ablation need be entertained. The operation should be done as soon after the condition is detected as necessary preparations can be made. The possibility of hemorrhage and the still greater possibility of infection make it imperative that intervention should be practised as speedily as possible. Patients may, however, live for a considerable time after the occurrence of this accident, even without treatment. Thus St. Braunwas, of Cracow, reports a case in which he had extracted the fœtus by abdominal section six weeks after it had escaped through a rupture of the uterus into the peritoneal cavity. The fœtus was bathed in pus, which filled the cavity of the abdomen. The patient, of course, died from chronic sepsis. In cases in which abdominal section is practised, the operation proper should be both preceded and followed by free administration of normal salt solution, either by intravenous injection or by hypodermoclysis.

Lacerations of the cervix occur chiefly as accidents of childbirth—although latterly they are encountered in occasional instances as results of forcible dilatation of the cervix. (See Dilatation of the Cervix.) When this operation is performed with too much rapidity and by one of the powerful instruments now in use, the divulsion may result, not merely in the separation of submucous fibres, but even in a complete severance of continuity of the cervical tissue. It may be said that laceration of the cervix, when occurring as the result of forcible dilatation or of parturition, is always caused by divulsion carried to a point beyond the resistant power of the cervical structures. Lacerations of the cervix may be either superficial or deep, extending as far up as the cervico-corporeal junction, and are, in reality, but examples of rupture of the uterus, the damage occurring in the lower segment of that organ and involving the cervical margin. More than one rupture of this kind may occur at once, occasioning what is spoken of as multiple or stellate laceration of the cervix. When lacerations occur chiefly within the cervical canal, but do not extend entirely through to the lateral vaginal surfaces of the cervix, they may result in a permanent enlargement of that canal. The attention of the profession was first called to the pathologic character of these injuries by Emmet, who devised the operation for their repair. (See Trachelorrhaphy.)

The *pathology* of lacerations of the cervix relates chiefly to antecedent and subsequent changes. The antecedent changes consist of those modifications of the cervical structure—e. g., fatty degeneration and œdema—occurring during the course of pregnancy, which result in a loss of the normal elasticity of the tissues. The subsequent changes relate to those interferences with involution, and those modifications of local nutrition, which are caused by the tear, and the con-

sequent interference with the circulation. After the receipt of the injury, laceration of the cervix rarely if ever heals spontaneously. Repair occurs by process of cicatrization; the tissue thus formed subsequently contracts; and the underlying cervical structures are distorted. When the laceration is bilateral the resulting contraction of the cicatricial tissue causes a retraction outward of the cervical lips, with consequent eversion of the mucous membrane. The mucous membrane itself, exposed on the everted surfaces of the cervix, presently undergoes glandular hypertrophy, giving to the unpractised eye the appearance of ulceration, and abounding in granulations. There is no doubt that many of the so-called "ulcerations of the womb," treated in the years gone by with repeated applications of lunar caustic, were, in reality, but eversions of the endocervix in a state of glandular hypertrophy. The enlarged follicles of the cervical mucosa manifest an augmentation of function corresponding with their abnormal development; and, as a consequence, the cervix is always covered in such cases with a clear viscid mucus, sometimes tinged with blood. Changes in the parenchyma of the cervix are equally marked and may present two extremes, namely, atrophy or hyperplasia. When the laceration is comparatively superficial, the resulting inflammation goes through all the consecutive stages from preliminary engorgement to final atrophy; but when the laceration is deep and the consequent cervical eversion is pronounced, there is so much mechanical interference with the circulation, particularly upon the venous side, that passive engorgement ensues, resulting finally in an actual increase of the tissue elements. This state of hypertrophy is sometimes associated with œdematous infiltration; but, as a rule, there occurs an organization of the adventitious tissue elements with consequent enlargement and induration of the cervix. These changes may be more pronounced in some parts of the cervix than in others, the difference being determined by the location, depth, and consequent influence, of the laceration. The body and fundus of the uterus, being largely supplied with blood by the ovarian artery, and being drained by the ovarian veins, are not subject to the influences arising in the injury of the cervix. It is noticeable, however, notwithstanding the fact that the upper zones of the uterus possess a practically independent circulation, that they undergo the post-parturient involutional changes tardily in the presence of deep injuries of the cervix. Glandular hypertrophies are, consequently, not uncommon in these cases in the corporeal endometrium. (See Endometritis.) The inflammations producing this increase in tissue, both glandular and parenchymatous, are manifestly dependent in a large degree upon mechanical disturbances of the pelvic circulation; but, from the facts that lacerations of the cervix never heal without at least superficial bacterial invasion, and that infection once established at the seat of laceration readily extends upward, these inflammations must be recognised as infectious quite as much as traumatic.

Symptoms of laceration of the cervix at the time of its occurrence

may be absolutely *nil.* The absence of all symptoms indicating laceration of the cervix accounts for the fact that the majority of these accidents are never discovered until long after their occurrence, when the patient presents herself for treatment for vague and indefinite pelvic symptoms. In occasional instances, however, the laceration is so deep, extending up to and involving the circular artery, that hemorrhage results. This symptom is often overlooked for a time under the impression that the flow of blood is nothing more or less than that which occurs in normal cases following delivery. When, however, this hemorrhage persists for a considerable time, imparting an arterial tinge to the otherwise dull-coloured lochia, it becomes the occasion for a local examination. Digital exploration at this time, particularly if done by an inexperienced operator, is liable to be negative, if not misleading, in its results. The cervix during the first few days following delivery is enlarged, dilated, œdematous, and flabby; its normal contour can not be detected, while superficial abrasions, or even deep lacerations, can not be distinguished by the touch. Under these circumstances the patient should be placed in the Sims position, the perineum should be retracted, and the cervix should be drawn down and carefully inspected, when the bleeding point, if within the area of a laceration, can be detected and controlled. In the later stages of a laceration—i. e., several weeks or months after delivery—there is vastly less difficulty in detecting the actual conditions. The patient may or may not complain of pain. Cicatricial deposits, particularly in the angle of laceration, and especially in cases of long standing, may impinge upon terminal nerve filaments and occasion severe distress, and that not only in the uterus, for through its intimate nerve connections with both the sympathetic and cerebro-spinal systems, this relatively slight local injury may cause a widespread perturbation of nerve function. It would seem in certain cases, as if the cervix under these circumstances were a sort of central telegraphic office, with radiating lines over which morbific impulses are telegraphed to the remotest parts of the system. Erratic behaviour of the apparatus of accommodation, eccentric disturbances of hearing, evanescent or persistent turgescences of the turbinates, congestions of the Schneiderian membrane, asthmatic disturbances, localized variations of cutaneous sensibility, and that congeries of nerve perturbations designated as hysteria, have been known to follow in the wake of this accident and to have been cured by repair of the cervix. These so-called reflex symptoms, however, never occur with that degree of constancy necessary for them to be accepted as indications of an existing laceration of the cervix. It may be said in short that there are no symptoms of a subjective character that are pathognomonic of this condition. Local examination alone detects the condition, which has existed, possibly, for years, without being suspected, either by the patient or her medical adviser. Introduction of the finger into the vagina will reveal the cervix with an irregular contour; it may be multilobular, each lobule being divided by a distinct

fissure (stellate laceration), or it may be divided into an anterior and a posterior lip (bilateral laceration), or it may be fissured upon only one side (single laceration). If examined by the speculum, these appearances may be much modified; as, for instance, if a bivalve speculum is employed, its dilatation will result in stretching farther apart the antero-posterior lip of the cervix in a bilateral laceration; indeed, in cases of long standing in which the eversion has become pronounced, the retracted lips may have been drawn up to the utero-vaginal junction, and, when distended by means of a bivalve speculum, the marginal contour of the cervix may entirely disappear. The picture presented in the speculum will be that of a double, elliptical, area of apparent erosion. This will be nothing more or less, in practically every case, than the hypertrophic endocervium. If, now, this patient is placed in the Sims posture, the perineum retracted, and the retractor intrusted to an assistant, the examiner may, by means of a volsella placed in the apex of each lip, draw the severed portions of the cervix into approximation. He will thus be enabled to determine the depth and other exact characters of the laceration.

The complications of laceration of the cervix are worthy of consideration. They naturally coexist with atrophies, hypertrophies, or hyperplasias of both the parenchyma and endometrium. As already indicated when considering the pathology of this lesion, bacterial infection of the laceration takes place at the time of its occurrence; progressive invasion, either of the contiguous mucous surfaces or of the opened lymph spaces, ensues; the result being either infection and enlargement of the pelvic lymphatic glands, with possible resulting suppuration, or infection with purulent accumulation in the Fallopian tubes, involving the ovaries in the general pathologic processes. These complications are frequently encountered and are directly traceable to the original injury for their causation. It not infrequently happens that laceration is not detected until an examination is demanded for symptoms of carcinoma. This disease, indeed, exists as a frequent complication of laceration, the carcinomatous process in many instances having its origin in the cicatricial covering of a cervical tear. Fibroids and other neoplasms may coexist with laceration of the cervix.

The *treatment of laceration of the cervix* consists essentially in restoring that structure, so far as possible, to its normal state. The steps by which this may be accomplished must vary according to the pathologic conditions present in the case; thus, if the case is one simply of laceration without marked tissue changes, the treatment will consist in revivifying the margins of the wound and approximating them by sutures; if, however, there is extensive hypertrophy, it may be necessary to remove, at least, a part of the enlarged segment of the uterus. At the same time, associated pathologic states in the endometrium must be appropriately treated.

Instruments for Trachelorrhaphy

Catheter, glass	1	Needle holders	2
Curette, dull	1	Nozzles, glass or Edebohls's hard rubber	1
Sharp (Sims's modified)	1	Retractor, small	1
Martin's	1	Intermediate	2
Récamier's	1	Scalpels	2
Dilators, different sizes	3	Scissors, straight	1
Hegar's, three sizes.		Shot compressor and shot.	
Forceps, hemostatic, two of each size.	6	Sound, uterine	1
Long dressing	1	Speculum, Sims's small	1
Rat-tooth dressing	2	Simon's, with handles and four blades	1
Bullet	2	Tenaculum, straight	1
Needles, assorted sizes	8	Tenacula, curved	2

Trachelorrhaphy, or the operation for repair of the lacerated cervix, is conveniently done as follows: The patient is placed in the dorsal position, her buttocks at the edge of the operating table, her knees well drawn up, her flexed legs being intrusted either to an assistant or to the efficient mechanical attachments of the modern operating table. A Jones's perineal retractor with a short blade is now inserted and the posterior lip of the cervix is seized with a self-locking volsella and is drawn down. Newman has devised an excellent reverse-acting, self-locking volsella (Fig. 136) which on being inserted into the cervical canal and expanded, becomes fixed in the uterine tissues. The instrument is an exceedingly convenient one, as its shaft lies along the mucous track of the cervical canal and becomes a convenient guide, both in denuding the surfaces and in passing the sutures. The downward traction on the uterus must be judiciously regulated, force beyond a few pounds never being exercised. Whenever distinct and sudden resistance is experienced in effecting the temporary prolapse of the uterus, it is to be construed as an evidence of adhesions, and is a danger signal admonishing the operator against more forcible traction. When the uterus is thus drawn down, the endometrium, if the seat of glandular hypertrophy, should be vigorously curetted, the mucus, blood, and *débris*, being carefully washed away with a

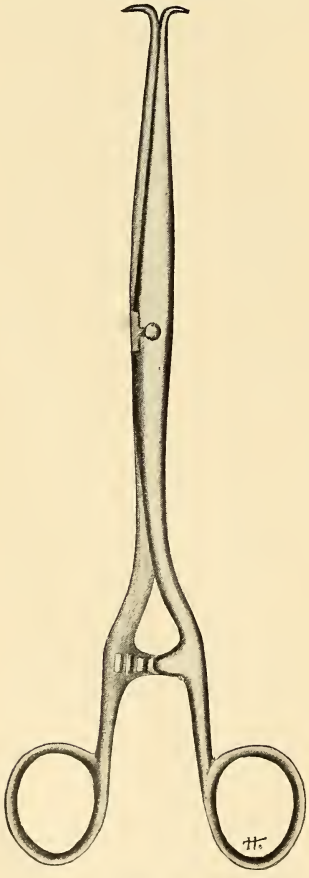

Fig. 136.—"Newman has devised an excellent reverse-acting, self-locking volsella."—Reed.

jet of bichloride water, after which the surface is dried and painted with pure carbolic acid. The next step consists in denuding the surfaces to be approximated. Their respective areas should be definitely determined in advance by making a preliminary approximation.

Fig. 137.—"A very good knife . . . is that devised by Newman."—Reed.

The denudation may be accomplished either by a knife or by scissors, preferably the former. A very good knife for the purpose is that devised by Newman (Fig. 137) and its sharp point is so arranged that it can be easily passed through the cervical tissue in the upper angle of the laceration. It is a good rule to begin the denudation by first outlining with the edge of a bistoury the tissues to be removed. These may then be cut away, leaving two equal, denuded, approximating surfaces. Great care should be taken to remove the deposit of cicatricial tissue from the upper angle of the laceration. In the case of a bilateral laceration, all the surfaces to be approximated must be denuded before the work of suturing is begun. The sutures may be inserted by means of a short, heavy, detached needle, which is employed by means of a needle holder; or, they may be inserted by means of an obliquely curved needle such as that used by Reed (Fig. 138). The sutures themselves should be of nonabsorbable material. Emmet does this operation with a silver wire, and annealed iron wire is employed by some operators. As a rule, however, the silkworm gut is the material of preference. Whichever material is employed, careful antiseptic precautions should be taken. Catgut has been used with success since the process of preparing it with formalin and boiling it has been perfected; it generally lasts fourteen days, which is long enough, while the facility with which the external and unabsorbed remnants are removed is a point in its favour. The suture should be passed beneath and on a level with each surface to be approximated, as illustrated (Fig. 139). Two, three, or even four, sutures may be required upon either side, the number being governed by the depth of the laceration. After all of them have been passed the volsella may be removed, the remaining traction on the uterus being exercised by means of the ends

Fig. 138. "An obliquely curved needle used by Reed."—Reed.

of the sutures on one side being gathered together in a forceps. The surface of the wound should be irrigated and removed by means of sterilized water. If there is no pulsating hemorrhage, no further attention need be given to hemostasis which will be effected by the approximation of the surfaces and the pressure of the sutures. The sutures are tied, beginning upon one side at the upper angle, care being taken that, as they are tightened, the underlying margins of the tissues are brought into accurate coaptation. Care should be taken to avoid tying the sutures too tightly, as tissue necrosis may thereby be induced and the success of the operation be compromised in consequence. After being twisted, if silver wire is used, or tied, if other material is employed, the distal ends should be cut off about an inch from the knot, and so arranged as to avoid causing mechanical irritation of the parts. The sutures, if of nonabsorbable material, should be left *in situ* for about ten days, antiseptic vaginal irrigation being practised twice daily during the entire time. To remove the sutures, the patient should be placed in the Sims position and each suture seized with long-fixation forceps and subjected to gentle traction. The loop of the suture will thereby be drawn up so that the point of a scissors blade may be easily insinuated beneath it. It is important that the stitches should be removed under inspection, for, if the effort is made to remove them by the sense of touch alone, there is a likelihood of cutting both ends of the loop near the knot, leaving the loop itself buried in the tissues. It is true that this is not a matter of any serious moment, but it may occasion annoying local infection; and the escape of a loop of suture material at some subsequent time is always construed by the patient as a more or less serious reflection upon the surgeon.

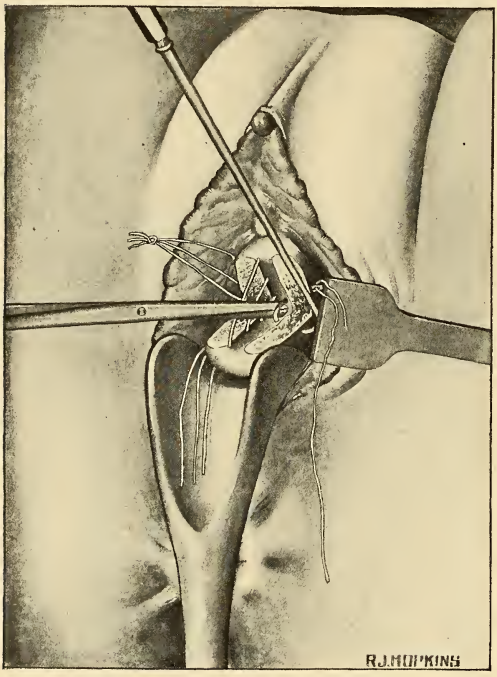

Fig. 139.—"The suture should be passed beneath and on a level with each surface to be approximated."—Reed (page 339).

Amputation of the cervix, in whole or in part, is demanded for hypertrophic and hyperplastic conditions that are sometimes associated

with and result from lacerations. Emmet (*Transactions of the American Gynecological Society*, 1897) believes that these conditions should be subjected to preliminary local treatment, consisting of douches, eliminative tamponade, alterative topical applications, or even local depletion by puncture. Treatment of this kind may, in some cases, so far reduce hypertrophy that amputation or excision is unnecessary. When, however, the desired reduction in the volume and consistence of the tissues is not realized by such conservative treatment, Emmet's operation of amputation may be adopted. He first draws the uterus down by gentle and steady traction to the vaginal outlet, always taking care to avoid a jerking movement which would be liable to rupture some blood vessel, especially if there has been a pre-existing intrapelvic inflammation. The cervix is steadily held by an assistant just within the vaginal outlet, for at this point the arteries will be placed sufficiently on the stretch to lessen their calibre, and thus to render the operation to a great extent bloodless. Care is taken to accurately determine the line of vaginal junction, since the bladder will be entered in front and the peritoneal cavity behind, if an attempt is made to remove what seems to be the cervix over which a mass of thickened vaginal tissue has been crowded. In those cases in which atrophy takes place as already described in this chapter, the field of operation can not be a large one at the beginning. An incision is now made round the cervix near the vaginal juncture; the subsequent dissection should be made by cutting always toward the centre as a precaution against entering the bladder and the peritoneal cavity, and with the object of removing a cone-shaped piece of tissue. As the operation advances, the excavation must continually be drawn up to the vaginal level so that the operator may have the parts under observation and the bleeding under control. As each blood vessel is divided, the neighbouring tissues should immediately be seized by an assistant and held as a fresh point for traction, when the vessels will promptly retract and cease to bleed. The cervix is to be removed segment by segment until underlying healthy tissue is reached. The most efficient instrument for this purpose is the pointed scissors which Emmet devised nearly thirty years ago for clearing out the angles in the operation for laceration of the cervix. After having removed the tissues in the manner just described, nonabsorbable sutures are inserted; Emmet employs the silver wire. The sutures are inserted antero-posteriorly. Those to either side of the cervical canal are inserted (Fig. 140) through the posterior lip, into the excavation, into the tissues at the fundus of the excavation, out again, and then through the anterior lip of the wound. The sutures that are passed coincidently with the cervical canal are introduced through the posterior lip of the wound, out again, in again through the posterior lip of the cervical canal, and out through the cervical canal. Another suture is passed similarly to the last, through the lip formed by the anterior wall of the cervical canal, out again and through the anterior lip of the cervix. As many antero-posterior

sutures are passed transversely to the cervical canal as may be required. "If," says Emmet, "we follow the course of either of these sutures it will be apparent that when the front suture, for instance, is twisted, the free vaginal surface must be drawn over the stump, and as the edge of the uterine canal is a fixed point, the former will be secured at that point, and a similar effect will be produced posterior to the cervical canal when the posterior suture has been twisted in the same manner. The result of thus securing these sutures will be that the edge of the divided mucous membrane on the vaginal surface, front and back, will be rolled over in contact with the edges of the uterine canal, and when primary union has taken place the natural calibre of the passage must be preserved. But before securing these, or any of the sutures, as many as may be deemed necessary should be first introduced on each side of the cervical canal. Here the loose vaginal edge is first caught up, and then the needle is made to include a sufficient portion of the uterine stump on a line with and lateral to the uterine canal, and in turn it should take up the vaginal tissue behind. The only difficulty is in catching up enough of the uterine tissue in the centre of the stump to hold it firmly in contact with the flaps after the sutures have been secured. But this difficulty can be overcome by using a properly-shaped needle with the pointed end slightly bent on itself. The passage of the needle is greatly facilitated by snipping with pointed scissors a sulcus in the tissues at a sufficient depth in front of the advancing needle, and from the bottom of this cut its point should be brought out to pass over to secure the vaginal edge.

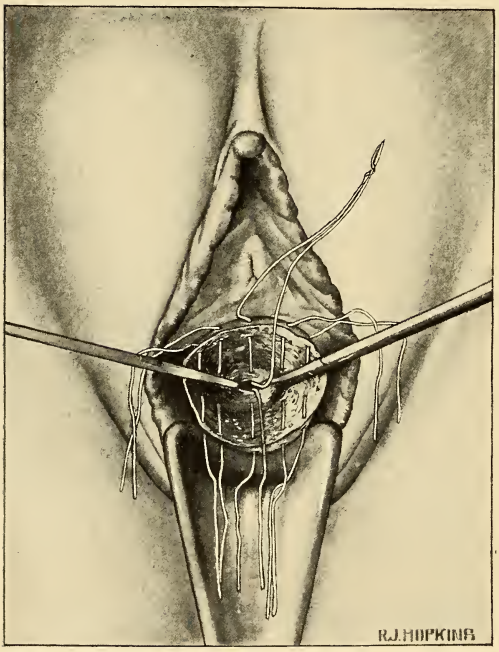

Fig. 140.—"Those to either side of the cervical canal are inserted through the posterior lip, into the excavation, into the tissues at the fundus of the excavation, out again, and then through the anterior lip of the wound."—Reed (page 341).

"After all the silver sutures have been twisted it will be made evident, by the introduction of a uterine sound for half an inch, that the canal has been left fully open, and it will be seen at the same time

that the vaginal tissues have been drawn over the stump and firmly secured to its surface.

"At the completion of the operation it is necessary that the uterus should be carefully replaced with the finger to its natural position, and it must be done without displacing the ends of the sutures, which have been carefully bent down on to the vaginal surface. As soon as the uterus is replaced in its normal position the lateral traction then exerted in the vagina will keep the vaginal covering in close relation with the stump.

"No surgical operation with which I am familiar yields a more uniform and satisfactory result than this one, when performed under the following conditions: The proper use of silver sutures, keeping the patient in bed for three weeks after the operation including the menstrual period when possible, and not removing the sutures before the nineteenth or twentieth day, when the parts will have become firmly united and the uterus greatly reduced in size."

Vesico-uterine Fistulæ.—These fistulæ are of two kinds. In one form the cervix is partially destroyed, and in the other form the fistulous opening occurs into the cervical canal and is so concealed that the cervix must be split during any operation for its obliteration. These fistulæ can only take place in the cervix.

It is important that a *diagnosis* should be made in these cases distinguishing between a vesico-uterine fistula and a uretero-uterine fistula. In each case the urine is discharged from the os uteri. Sometimes a probe can be passed through the fistulous opening from the bladder into the cervical canal or *vice versa*. Clear fluids injected into the bladder will come out of the os uteri. If continued pressure is kept up in the cervical canal no acute nephydrosis will occur if the fistula is vesico-uterine and not uretero-uterine. The electric cystoscope should be of great assistance. With it one should be able to make out any perforation of the bladder wall, and thus to distinguish between vesical and ureteral fistulæ. (See Examination of the Bladder.)

Prognosis.—These fistulæ oftentimes heal very kindly owing to the fact that the thick wall of the uterus, during the process of healing, is likely to close the opening.

Treatment.—The treatment is the same as that for vesico-vaginal fistula, namely, closure by suture. Each of these cases must be judged upon its own merits and the operator must think out for himself his exact method of procedure. If the main principles, previously stated, are adhered to, he will, in all probability, meet with success. If the fistula is situated close to the cervix the anterior lip may be made use of to close the opening. If a great deal of the anterior lip has been destroyed it will then be necessary to use the posterior lip, and if this is done the menstrual fluid will be discharged into the bladder and out through the urethra. It is unfortunate to have this happen and if possible it should be avoided.

Reed's Operation for Vesico-uterine Fistula.—The condition is best controlled by a free incision, dividing the uterus from the bladder, just as is practised in the preliminary step of vaginal hysterectomy. The bladder, thus separated, should be drawn down with a forceps or volsella (Fig. 141); the fistula will then be brought into clear view and can be closed by a double line of continuous catgut sutures. If the fistula opens directly into the uterus (Fig. 142), the latter should be curetted and packed and a single suture should be placed across the orifice of the fistula as it presents at the denuded anterior uterine surface. If the fistula traverses the uterus longitudinally and opens at the cervical margin (Fig. 143), a curved director should be inserted and the uterine tissues split up to the point of entrance of the fistula. If the tract has become cicatricial it should be carefully dissected out, and the place that it formerly occupied should be closed by repeated interrupted sutures. In splitting up the uterine tissues, the circular artery is more than likely to be divided. The hemorrhage may be somewhat difficult to control. This, however, is best done by passing a deep suture *en masse* to either side of the incision, so situated as to embrace the severed ends of the artery within its grasp.

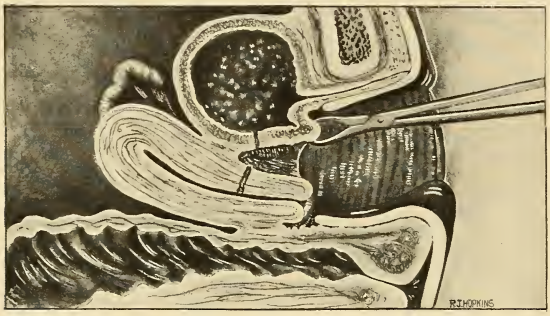

Fig. 141.—"The bladder, thus separated, should be drawn down with a forceps or volsella."—Reed.

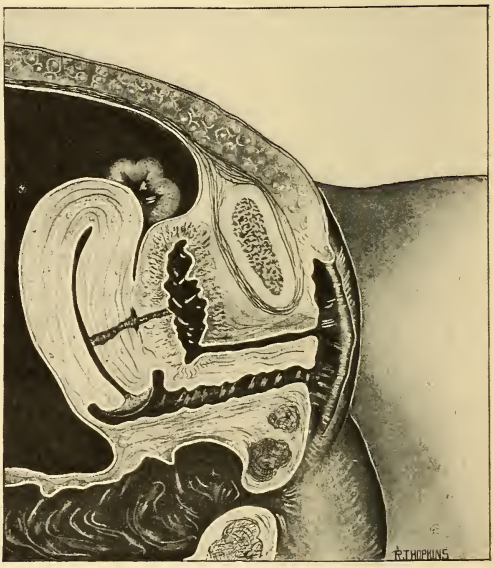

Fig. 142.—"The fistula opens directly into the uterus."—Reed.

Both the bladder and the uterus having been thus repaired, the parts should be brought into apposition and closed by interrupted sutures. The vagina should be packed with antiseptic gauze and the

usual precautions observed during convalescence. The most notable of these precautions is the introduction and retention of a sigmoid catheter during several days after the operation. The evacuation of the bladder, either by catheter or spontaneously, at intervals of not more than three hours during the succeeding week should be rigorously practised.

Wounds of the uterus from external causes are of occasional occurrence. The injudicious use of the *uterine sound* sometimes results in perforation of the walls of that organ. Cases of this kind have been recorded by Lawson Tait and others. If the instrument is aseptic the accident is rarely followed by serious consequences; if, however, infection ensues, death may follow. The introduction into the uterus of catheters, sounds, and bougies for the purpose of inducing criminal abortion, generally results in more or less injury to the endometrium, if not to the deeper structures of the wound. Injuries of this kind, when inflicted by unclean instruments, result in those deaths from constitutional sepsis which occur so frequently in the annals of crime. There is probably nothing more dangerous to a woman than an effort, particularly on her own part, to induce abortion by intrauterine instrumentation. In many cases of perforation of the uterine wall by the sound, at the hands of experienced operators, the diseased condition of the uterus itself is responsible for the accident. The walls of the uterus are very nonresistant in all inflammatory conditions, but particularly so in the presence of puerperal infection. In ordinary cases of subinvolution, the uterine tissue is very friable. When the walls of the uterus are soft and œdematous as the result of a flexion at an acute angle, the muscularis is easily penetrated; and the same is true when the organ is the seat of malignant disease, such, for example, as sarcoma, syncytioma malignum, and adenoma malignum. Under these circumstances the uterus is sometimes perforated by means of a curette, many of these instruments being so constructed that they offer no safeguard against the accident. Gau, of Cincinnati, has devised an excellent curette with a safety point and edge calculated to prevent accidents of this character (Fig. 144). The diagnosis of uterine perforation is not difficult. Perforation may be suspected whenever the sound or

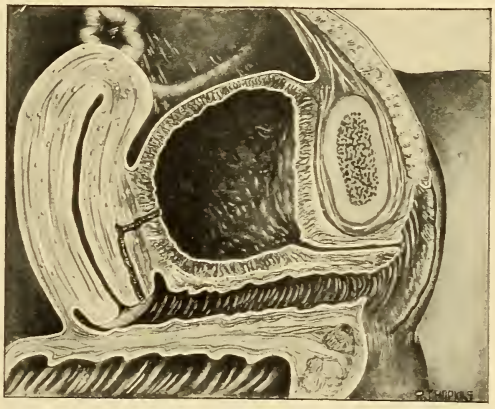

Fig. 143.—"The fistula traverses the uterus longitudinally and opens at the cervical margin." — Reed (page 344).

curette penetrates farther than the previously ascertained limits of the uterus. The treatment consists in quietude and vigilance. In a septic case it may be prudent to await the development of menacing symptoms, which, as soon as they occur, should prompt the surgeon to extirpate the uterus. Intrauterine injections are to be carefully avoided, even when administered by means of a recurrent syringe, for the reason that any force, however slight, may be sufficient to carry infectious material from the uterus into the peritoneal cavity. In some cases the injury inflicted, particularly by the curette, may cause an opening which may result in the protrusion either of omentum or of a loop of intestine. In the presence of this complication the protruding structure should be replaced and the uterine cavity packed pending the completion of preparations for hysterectomy, which should be done as promptly as possible. In cases in which injury has occurred to the intestines, as rarely happens from either the sound or the curette, an abdominal section should be done at once.

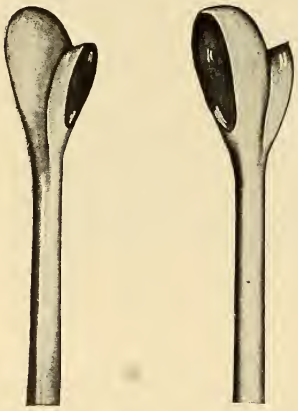

Fig. 144.—"Gau has devised an excellent curette with a safety point and edge."—Reed.

Gunshot wounds of the uterus, particularly when pregnant, are recorded. Benbrook (*Medical Times*) relates an interesting case of this sort, in which a 44-calibre pistol ball passed in just below the crest of the ilium going downward and backward, and a second one entered the abdominal cavity from a point between the eighth and ninth ribs. Three days later, the woman was taken with hemorrhage from the uterus associated with labour pains, and resulting in the expulsion of a quantity of blood clot together with a bullet, which had passed into the cavity of the uterus through the fundus. Another case by Robinson (*Lancet*) revealed the fact that a ball had entered the abdomen a little to the right and below the umbilicus; an hour later labour set in, resulting in the instrumental delivery of a dead child near full term, with a gunshot wound in its right shoulder. The ball was found in the *débris*. The mother made an uninterrupted recovery. Nietert records (*Medical Review*) an interesting case of a self-inflicted gunshot wound in the abdomen of a pregnant woman, the ball passing through the uterus and the arm of the child, an abdominal section being followed by the recovery of the mother. Gunshot wounds generally occur either at the fundus or the anterior wall of the uterus. Their infliction is followed by pronounced shock and collapse, pain in the abdominal region, at first located at the site of injury, but presently becoming diffuse, while symptoms of peritonitis of the diffuse form shortly manifest themselves. In the course of a few hours pains with rhythmic contractions of the uterus occur, whether in the

impregnated or the nonimpregnated uterus. In either instance the organ is more or less distended; in the first by the products of conception, and in the latter by clots. The gravid uterus in many cases throws off its contents, a fact which does not in the least diminish the necessity for prompt intervention. As to *treatment*, it may be laid down as a rule that every case of perforating wound of the abdomen of a pregnant woman would be subjected to an exploratory abdominal section without reference to symptoms. The probability of perforation of the uterus and of the consequent escape of amniotic fluid and blood into the peritoneal cavity, makes it imperative that intervention should be both prompt and thorough. The fact, also, that in these cases the womb and its contents act as a sort of shield to the intestines, saving them from injury, increases the prospects of the mother and forms an additional reason for speedy intervention. The character and extent of the operation must be determined by the conditions revealed by the exploratory incision. If there has been extensive destruction of uterine tissue, offering no reasonable prospect of recovery, with the uterus *in situ*, hysterectomy should be done. This rule applies whether the uterus has been emptied or not. All *débris* should be washed from the abdominal cavity by copious irrigation with normal salt solution, and intravenous injection or hypodermoclysis should be practised in the presence of the generally pronounced shock, or whenever there has been a free loss of blood. If the gravid uterus has thrown off its contents, the necessity for abdominal section is all the more imperative, for the very contractions of the uterus which result in the expulsion of the embryo, result also in the extrusion of the liquid contents of the uterus into the peritoneal cavity.

Cattle-horn wounds of the uterus are of occasional occurrence in the cattle-raising districts of the world. A number of these cases have been reported describing accidents with revolting details but attended with a singularly slight mortality. These injuries considered as abdominal wounds may or may not involve the uterus; the latter class need not be considered in this connection. Of the former it may be said that they divide themselves naturally into those wounds which involve the uterine wall alone, and those which involve both the uterus and the child. The prospect of the child living under these circumstances depends, naturally enough, upon the stage of pregnancy and the degree of injury sustained by the child. Occasionally the rent in the uterine wall is so great that the fœtus and secundines escape into the abdominal cavity; and, even under these circumstances, a viable child has been known to survive. Harris (*American Journal of Obstetrics*, 1887) collected the histories of nine cases of this character, with a mortality of four women and four children. In an injury of this character the diagnosis declares itself. Whether a hysterectomy should be done in these cases, or whether the wound in the uterus should be treated just as in an elective Cæsarean section, must be determined at the time by the conditions presented. As a rule the uterus contracts

vigorously after the receipt of the injury and particularly after being emptied. In certain of the recorded cases occurring before the modern surgical epoch, closure of the uterine wound was effected by suture, and even in cases of recovery the treatment was destitute of those features which we should to-day designate as antiseptic. In some of the recorded cases subsequent pregnancies with successful deliveries have occurred. These facts should prompt the operator to be cautious before sacrificing a womb by ablation, even though it may be the seat of extensive injury.

In those cases in which exploratory incision reveals the fact that the perforating wound of the uterus is small, delivery may be effected by the Cæsarean section. (See Cæsarean Section.) In such cases it is important that the gunshot wound be carefully closed on the peritoneal surface of the uterus.

Foreign bodies in the uterus are occasionally encountered in practice. They may consist of pledgets of cotton or of gauze left by accident in the uterine cavity in the course of treatment, the broken end of a uterine electrode, or the stem of an intrauterine pessary. Schauta (*Centralblatt für Gynäkologie*) reported a case in which a hard-rubber pessary, 2.5 inches in long diameter, inserted into the vagina, had escaped into the uterine cavity from which it was delivered with extreme difficulty by *morcellement*. Neugebauer, in his collected series of 297 cases of pessaries neglected and incarcerated in the vagina or escaped into adjacent parts, notes six in which a vaginal pessary slipped into the uterus. Bodies usually found in the uterine cavity are hairpins or broken-off ends of instruments employed for the most part by patients themselves in an effort to produce abortion.

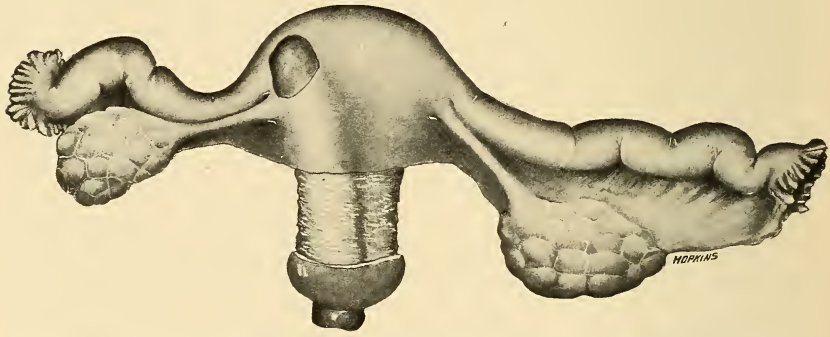

Fig. 145.—"W. E. Ashton reports an interesting case in which . . . a false passage was made from the internal os through the anterior uterine wall."—Reed.

W. E. Ashton reports (*Medical Bulletin*) an interesting case (Fig. 145) in which, as the result of an attempt to forcibly insert a tupelo tent, a false passage was made from the internal os through the anterior uterine wall to a point above the utero-vesical fold where the tip of the tent protruded into the peritoneal cavity. Laminaria and

other tents introduced into the cervical canal have escaped into the uterine cavity proper. Mittermaier reports a case in which a loosely tied silk ligature had become the nucleus of an infection and of a foreign body following an operation for fibroid, and another case in which the glass catheter used for irrigating the uterine cavity had broken *in situ*, the fragments having become so thoroughly embedded that all attempts to remove them had proved futile. The diagnosis of some of these cases in the absence of a definite history can be made only by forcible dilatation of the cervix, and either instrumental or digital exploration of the uterine cavity. The treatment consists in dilating the cervix and, if possible, removing the foreign body. This is sometimes a matter of extreme difficulty. Thus Schauta, in his efforts to remove the long incarcerated pessary from the uterine cavity, perforated the latter repeatedly with a Pacquelin cautery for the purpose of getting some means of grasping the ovoid body. The removal of smaller foreign bodies can generally be effected by means of the curette, the Emmet curette forceps, or the Lawson Tait colpocystotomy forceps. In some cases, however, this will prove unavailing; thus, Mittermaier found it impossible by such means to remove the fragments of broken glass from the cavity of the uterus, to accomplish which he had to divide the uterus from the bladder, draw the fundus down into the vagina, and make an incision into the uterine cavity. Having removed the glass, he stitched up the incision, and returned the womb to its normal position. It is important to bear in mind in cases in which such an operation is necessary that the operation should be made anteriorly, rather than posteriorly, to the cervix. When a foreign body results in injury and consequent infection, hysterectomy may be done, as Ashton did successfully in the case to which reference has just been made.

CHAPTER XXVI

INFECTIONS OF THE UTERUS

The uterus—The endometrium—The myometrium—Bacteria of the uterus—Infections: (*a*) Mixed, (*b*) specific—Endometritis and metritis—Pathology—Causes—Symptoms—Diagnosis—Treatment: (*a*) Topical, Reed's method; (*b*) curettage.

The **uterus** being a frequent seat of infections, a proper comprehension of them must presuppose a knowledge of (*a*) the endometrium, (*b*) the myometrium, (*c*) the bacteria of the uterus, and (*d*) the recognised infections in their clinical, pathological, and therapeutical aspects.

The **endometrium** consists of a stroma of fibro-connective and muscular tissues in which are embedded glands covered by a single layer of columnar ciliated epithelium. It contains lymphatics and nerves, and the mucous glands are large and numerous. The endometrium is not supplied with separate blood vessels, but receives its nutrition from the superficial capillaries of the uterus. The ciliated columnar epithelium lines the entire uterus, also the uterine glands, and is continued through the Fallopian tubes. As the endometrium approaches the external os it loses its cilia and becomes blended with the pavement epithelium upon the vaginal portion of the cervix. The glands are tubular and narrow, dip down to the muscularis, and constitute a large portion of the volume of the endometrium. These glands are active and maintain a free secretion upon the surface of the membrane, with a plug of thick mucus in the cervical canal. Lymph spaces and vessels are abundant throughout the uterus, lying in the interglandular spaces around the bundles of muscular fibres and in the serosa, and converging into large channels which pass outward in the broad ligaments. The cervical endometrium has a peculiar arbor vitæ arrangement, is more dense than the corporeal, and is attached to the muscularis by looser tissue; it does not participate in menstruation. The normal secretion of the endometrium is alkaline in reaction; the corporeal mucus is clear and watery, the cervical, viscid. One important function of the cervix is to close as by a sphincter the uterine cavity; the great function of the corporeal endometrium is to form the decidua and nourish the embryo. A knowledge of this function of the cervix should of itself forbid the much-abused operation of forcible cervical dilatation in virgins. The gland crypts of the cervix readily become a culture bed for germs, which may long remain therein in an attenu-

ated form, and under favourable conditions develop new cultures and activity.

The endometrium, says McMurtry, is one of the most variable tissues of the body. It is subject to alterations that are physiologic, so that it is most difficult to establish a normal appearance that is typical. This fact often leads to a mistaken diagnosis of endometritis. The endometrium is suffused with blood during menstruation, undergoes marked disintegration at that time, and is afterward regenerated. During adolescence there is an increase in glandular tissue; during pregnancy this is even more marked, and atrophy supervenes after the menopause. The blood supply of the uterus is altered by physiologic and pathologic conditions extraneous to that organ, such as nervous states and wasting disease. These observations are of the utmost importance in the practical diagnosis and treatment of uterine diseases, and will convince the painstaking observer that the common diagnosis of endometritis, followed by aggressive instrumentation and chemical antisepsis, is a grave error both in diagnosis and treatment.

The secretion of the uterine cavity is alkaline; that of the vagina acid. Under normal conditions, the acid secretion of the vagina is a protection from pathogenic organisms and the endometrium is always sterile. Pathogenic cocci and other germs which might enter from adjacent cutaneous surfaces perish in the acid vaginal secretions, which are unsuited for their growth. The reaction of the vagina, however, may be altered by the presence of inflammatory products, so that infection may occur through this route.

The epithelium on the crests of the endometrial folds is usually described as having cilia, which Wyder insists have a motion from the os internum toward the fundus. Hofmeier (*Centralblatt für Gynäkologie*) criticises this view. Not only were his own studies conducted upon fresh uteri removed from mammals, in which the conditions ought to be the same as in the human female, but he also examined organs removed at the operating table and at once immersed in warm saline solution. In several of these latter he demonstrated conclusively, by removing strips of endometrium and placing them under the microscope, that minute particles of charcoal were invariably carried by the ciliary movement *from the fundus toward the os internum.*

This observation of Hofmeier's seems at least to be in harmony with an intelligent design of Nature by which obstacles are interposed to the easy invasion of the upper reaches of the genital tract.

The endometrium, responsive to the increased nutrition which comes from the premenstrual afflux of the blood to the pelvis, undergoes a sort of periodical hypertrophy, preceding each onset of the monthly flow. (See Normal Menstruation.) The exuberant epithelium undergoes a sort of desquamation. Von Kohlden (*Centralblatt für Gynäkologie*), who has studied the endometrium during and after menstruation, states that immediately after menstruation large gaps are seen in the superficial layer of the epithelium, and that during men-

struation the entire epithelial layer is cast off, and that there is infiltration and hemorrhage into the mucosa. This infiltration may extend through two thirds of the thickness of the latter. The blood clots which are found within the uterus contain desquamated epithelium and glands. No true solution of continuity of the endometrium can be established. Von Kohlden has never been able to find the giant cells described by Leopold, or evidence of dilatation and tortuosity of the glands. The reproduction of epithelium begins *de novo* within the glands, not from islands of cells which were not cast off; there is also a new formation of blood vessels. Löhlein (*Ibid.*) prefers this expression to either "membranous dysmenorrhœa" or "exfoliative endometritis," since dysmenorrhœa is a prominent symptom in only one half of the cases, and most observations show that there is no real inflammatory trouble. He believes that the membrane bears more of a resemblance to a product of conception than to that of inflammation.

The **myometrium**, or the muscularis of the uterus, consists of bands of decussating fibres arranged in different directions and in more or less definite concentric layers. Within the meshes of this fibrillation are to be found numerous nutrient vessels, branches of the uterine and ovarian arteries, with their accompanying veins. There are also freely interspersed within the muscularis numerous lymphatic vessels, which in the nongravid uterus are minute and generally closed, but which during pregnancy and immediately after parturition are greatly enlarged, their orifices communicating directly with the placental site. There are also numerous nerve filaments, derived, for the most part, from the sacral sympathetics.

The Bacteria of the Uterus.—From just within the os externum upward, says Professor Sinclair, the female genital tract in health is free from bacteria.

Confusion has arisen from methods of obtaining material for microscopic examination and cultivation experiments. Many observers have not succeeded in getting rid of the drop of mucus at the external os which should be considered as vaginal, and so have obtained results vitiated by the presence of vaginal bacteria in the material examined.

Another trifling question which has received too much attention is the limit of the vagina in case of laceration of the cervix. The discussion is mere logomachy. The part of the cervical canal which, by reason of laceration, is exposed to the vagina, must count as vagina from the point of view of bacteriological research. The part is well worthy of examination and comparison with the vagina and cervix proper, because of the change in the reaction of the secretion, which is alkaline within the lacerated portion; the difference in anatomic structure of the part which is cervical, and the inability of its lacerated muscle to completely contract, thus leaves the fissure in a state of stagnation.

The external os uteri, then, thus defined, is the boundary line between the vagina which in health swarms with all sorts of bacteria, and

the canal of the cervix and body of the uterus which in health is absolutely free from germs. Upon this point at least there is almost absolute unanimity among the bacteriologists.

Winter, who differed so egregiously from the majority with regard to vaginal bacteria, found, on examination of the healthy uterus with apparently healthy secretion, no bacteria in the cervix. When the cervical secretion was purulent he found bacteria in the cervical canal. The material on which he worked consisted of uteri obtained by extirpation. He reached the following conclusions: (1) The healthy uterine cavity contains no micro-organisms; (2) the vicinity of the os internum in half the cases contains no bacteria; (3) the cervical secretion of every healthy woman contains numerous bacteria, and in pregnancy the bacteria, especially the bacilli, increase to a large extent. These statements coincide with those of many other German bacteriologists, including Lomer and Bumm. Goenner, who made numerous observations, found bacteria in the cervix of pregnant women, but he failed to cultivate any. From this experience he draws conclusions against the theory of self-infection.

Solowieff examined women suffering from gonorrhœa or from tuberculous disease. He found micro-organisms in the cervix in 39 out of 45 women examined. In 7 cases he found streptococci and staphylococci. He concluded that bacteria are frequently found in chronic endometritis. Acute puerperal endometritis depends upon the presence of pyogenic bacteria. He reached the conclusion that the possibility of self-infection from the genital canal must be admitted.

Brandt (*Zur Bacteriologie der Cavitas Corporis Uteri bei den Endometritiden*) found, in 22 out of 25 cases, bacteria in the cavity of the uterus, and in 31 per cent of cases of endometritis, he found pathogenic organisms. Similar results of examinations have been published by many others.

Menge published the results of some work in 1893. He always found the cervical canal free from germs except in cases of gonorrhœa. In these the gonococcus was always found in the cervical canal, and in many cases he obtained the bacterium in pure cultivation. In pregnant women infected with gonorrhœa he always found the gonococcus and made pure cultivations from it. The secretion of the cervical canal was always alkaline.

Stroganoff made observations on women during menstruation. After complete cleansing of the os externum he always found the canal free from bacteria. In elderly women, Stroganoff found the cervical canal free from bacteria in 50 per cent. When the uterus was prolapsed, bacteria were always found in small quantities in the cervical canal. In pregnant women under ordinary conditions he always found the canal free from bacteria. Stroganoff therefore concluded: (1) in normal circumstances the cervix contains no bacteria; (2) the normal cervical secretion possesses a bactericidal quality; (3) in the genital

canal the os externum forms the dividing line between the germ-containing and the germ-free portions.

Bumm maintained in 1895, that in chronic endometritis of the body and cervix, in hyperplastic conditions resulting from inflammation, as well as in the catarrhal form, no micro-organisms can as a rule be demonstrated to exist. The continuance of the disease of the mucosa does not depend upon the presence of micro-organisms. In a small number of cases there may be found in the secretion, but not in the tissues, of the diseased mucosa, a small number of bacteria including pyogenic cocci. These must usually be considered accidental accompaniments of the endometritis.

Wertheim says that gonorrhœal infection of the uterus always causes a purulent catarrhal endometritis, which, when it runs a chronic course, leads to hyperplastic-hypertrophic changes in the glands. The inflammation also extends frequently to the myometrium, and it is less marked in the cervix than in the cavum uteri. In about half the cases, the gonococcus was demonstrated in the secretion, and pure cultivations were obtained. No other bacteria were ever found when the gonococcus was present. Wertheim concludes that the external os presents no barrier whatever to invasion by the gonococcus.

Gottschalk and Immerwahr examined 60 cases and found bacteria, including *Staphylococcus pyogenes*, in the uterine canal in 65 per cent. They concluded that there was a secondary invasion of the endometrium by the staphylococcus in connection with a gonorrhœal infection which had run its course or become chronic.

Menge made his investigations on 50 pregnant women. Of these, 34 appeared to be without any disease whatever; in 16 there was something suspicious about the discharge. He found the gonococcus in 4 cases. In only 3 others were cultivations obtained, and these were white saprophytic masses which softened gelatine very slowly. He attributes their presence to filth from the vagina. Microscopic examination did not reveal the presence of cocci. Bacteria were seen with the microscope, but could not be cultivated. No bacteria which we know, that is to say, which can be cultivated by methods usually employed for aerobic and anaerobic germs in acid or alkaline media, or suitable for the gonococcus, could be discovered.

The conclusion which Menge reaches is, consequently, that with the exception of the gonococcus no bacteria are found as a rule in the cervix of pregnant women.

The material which Menge employed for his further work consisted of the extirpated uterus in 50 cases suited for operation. He was thus able to eliminate the errors arising from the necessity of obtaining secretion through the os uteri. The diseased conditions which called for operation had, however, led in many cases to the invasion of the cervix by bacteria which had only a modified interest for the gynecologist.

In 20 cases Menge found nothing to suggest pathologic changes in the endometrium.

In 30 cases there existed some turbid slimy discharge or other changes suggestive of gonorrhœal infection.

Of the 20 normal cases the cultivation material remained absolutely sterile in 16. In the remaining 4 cases only colonies of saprophytes were discovered. Vaginal bacteria were also found by other methods of cultivation, including an anaerobic streptococcus. In a large proportion of the suspicious cases the gonococcus was found. All the rest were considered to be vaginal bacteria.

It was found in the course of examination of another series of uteri extirpated for various reasons, that the tubercle bacillus existed in the canal of the body and cervix when tuberculous disease affected the uterus or tubes. When necrotic tissue was present, as in cancer of the vaginal portion of the uterus, innumerable saprophytic bacteria were found to flourish.

Among the causes of the immunity from bacterial invasion of the cervical canal Professor Sinclair suggests:

1. The difference in the reaction of the secretion, which keeps away from the cervix the facultative aerobes and pathogenic organisms which sometimes gain a footing in the vagina.

2. The sudden change in the calibre of the canal.

3. Increase of the muscular power of the walls of the canal.

4. The downward stream of the secretion, which may add another mechanical influence.

5. Some germicidal quality in the secretion—that is, in the leucocytes and in the fluid.

6. The presence of the gonococcus when it has obtained access to the cervix.

In reference to this last point there can be no doubt that the os externum and all the influences at work in the cervix present no obstacle to the advance of the gonococcus, and there is reason to believe that the presence of the gonococcus has some deterrent influence on the development of other bacteria.

From what has now been said about the cervical canal, and *a fortiori* about the canal of the uterus as a whole, certain practical conclusions may be indicated without unpardonable irrelevancy. It must be obvious that the cervical canal of the pregnant or parturient woman does not require disinfecting, and that any proceedings with that object are, to say the least, unnecessary.

When the cervical canal is found to be the source of gonorrhœal discharge in the woman in labour, disinfection is not possible. From the bacteriological standpoint, attempts to disinfect the cervix before or during labour are inadvisable.

In women suffering from fibromyoma of the uterus, it used to be the custom during operation to dissect out or destroy by cautery the mucosa of the cervix, for fear of the stump in the intraperitoneal

operation becoming infected. The fear of infection at this point was also used as an argument in favour of pan-hysterectomy. It is obvious from the teaching of bacteriology that all these operative details are unnecessary, and the argument as to pan-hysterectomy is all on the other side.

Some interesting reflections arise in connection with this subject in relation to the vicissitudes in the history of laminaria tents. In Sinclair's opinion, tents are still the unrivalled means of dilating the nonpregnant uterus. The tents can be disinfected, the *bouchon muqueux* can be removed from the os externum, and then the canal is germ-free. Whence arise the exceptional cases of acute bacterial infection following the use of tents? Probably from some occult arrested condition of the gonococcus or from the life energies of bacteria not yet discovered.

We are now in a position to appreciate the dictum: *The asepsis of the healthy genital canal in a pregnant woman begins at the introitus vaginæ, and the germ-free portion begins at the os externum.* In the nonpregnant woman the cervical canal is also germ-free.

It is hardly necessary to consider the cavity of the uterus as a distinct part of the genital tract—a conclusion in which Professor Sinclair is in accord with other advanced investigators. The result of such consideration is to emphasize the fact of immunity from organisms. All the work of bacteriologists who have obtained material by the curette or spoon, as applied to the cavity, may be set aside as vitiated by the mixing of material from the vagina. The most trustworthy results have been obtained by examination of the uterus immediately after extirpation. Wertheim, whose work was pursued chiefly with the object of investigating the pathology of the sexual organs resulting from gonorrhœal infection, concluded that the cavity of the uterus contained either the gonococcus or no bacteria of any kind.

Menge worked on the vast material of 118 uteri obtained by extirpation, and the uterine canal in every case was immediately examined for bacteria both by microscopic examination and by cultivation experiment. He devoted a good deal of time and trouble to the investigation of pyometra, which is almost always a result of bacterial invasion from malignant disease of the cervix, a work of supererogation as far as our subject is concerned. He might as well have given us the results of researches on the bacteria which infest the cancerous area itself and produce the foul smell of the discharge and other phenomena.

On the ground of bacteriological researches Menge concluded that, neither in the secretion, nor in the tissues of the mucosa of the normal cavity of the body of the uterus, did bacteria exist which could be cultivated in our usual media; and that, neither in the secretion, nor in the tissues of the mucosa of such uteri as showed in the corporeal mucosa the usual anatomic changes marking the individual forms of chronic endometritis with small-cell infiltration, did bacteria exist which could

be cultivated according to any of our known methods. An exception must always be made as to the gonococcus and the tubercle bacillus.

With regard to the tubercle bacillus it is a curious fact, to which Professor Sinclair calls attention, that though tuberculous disease exists either primarily or, more frequently, secondarily, in the cavity of the body, it seldom extends downward beyond the os internum, while in most cases of malignant disease of the cervix, the process comparatively seldom extends upward beyond the os internum.

Individual cases of chronic endometritis stand probably in some causal relationship with the bacterial producers of puerperal infection and intoxication. The chronic endometritis of the nonpregnant woman is, however, not perpetuated by these micro-organisms.

The cavity of the body of the uterus can be invaded by bacteria, or can for a considerable time harbour bacteria when it is injured, and bacteria are conveyed to it by direct inoculation, or when the defensive power of the cervix is inhibited by dilatation and the unfolding of its rugæ, either by new growths or by products of conception.

Infections of the uterus may be appropriately classified as (*a*) mixed, and (*b*) specific. The *mixed infections* are those in which pathogenic bacteria of various classes are carried into the uterus and establish inflammatory changes in the endometrium, or possibly subsequently in the myometrium, or even in the perimetric structures. As will be seen when the pathology of these infections is considered, they are but rarely limited, at least in their sequent changes, to the lining membrane of the uterus; but through the utricular glands or the open lymph spaces the infection extends into the underlying muscular structure; or, in the absence of absolute invasion by morbific micro-organisms, the secondary inflammatory phenomena, in view of the nonexistence of a submucous connective tissue within the uterus, are manifested directly in the myometrium. *Specific infections* probably never exist as such if the term is construed to mean an infection due *exclusively* to a particular micro-organism; there are, however, cases in which a special bacterial organism—e. g., the *Streptococcus pyogenes*, the gonococcus, the *Bacillus tuberculosis*—exercise a predominating influence in producing pathologic changes, some of which are characteristic of the respective specific infection. It is probably not a demonstrable fact that any well-developed infection, however closely it may approximate the specific standard, ever exists except as a mixed infection; yet, as in the cases of puerperal fever, gonorrhœa, tuberculosis, and especially in parasitic invasions—e. g., the echinococcus—the organism which exercises the controlling influence is so distinct, its characteristics are so well understood, its clinical manifestations are so definite, that the condition should be discussed as one of specific infection.

Endometritis not depending upon specific micro-organisms for its causation, is the first and most frequent manifestation of ordinary mixed infections of the uterus. This term, etymologically, means an inflammation of the lining membrane of the uterus. There is serious

question whether this condition ever exists as a distinct clinical and pathologic entity—although Welch has stated that he has seen cases of genuine inflammation which can be called nothing but endometritis (*American Obstetrical and Gynecological Journal*). The connection between the endometrium and the myometrium being intimate, there being no intervening cellular structure and a common circulatory and lymphatic arrangement, it follows that inflammatory processes originating in the endometrium are exceedingly prone to penetrate the muscularis. In those cases in which the inflammatory process is limited to the endometrium, such limitation probably exists simply in consequence of either the relatively slight virulence of the infectious elements, or the relatively short duration of the disease, or, a third possibility, because resolution has taken place in the deeper structures. As a matter of fact, inflammatory exudations are generally observed in at least the superficial striæ of the muscularis in practically all demonstrated cases of endometritis; and it is also true that in many cases of infections which must of necessity commence in the endometrium, the most essential pathologic changes are manifested in the parenchyma. It is to be concluded, therefore, that, pathologically speaking, infection of the endometrium implies an inflammatory disturbance, not alone of the mucosa, but also of the muscularis, and should, therefore, be designated as **metritis**.

Bäcker denies that inflammation of the uterine mucous membrane exists as a separate condition. He believes it to be always associated with inflammation of the body of the uterus, and classifies it according to the French plan among the *metritides*. He divides metritis into the following groups:

I. Uncomplicated infectious form: (*a*) catarrhal metritis; (*b*) gonorrhœal metritis.

II. Complicated forms: (*a*) metritis post abortium; (*b*) metritis exfoliativus; (*c*) metritis atrophicans.

The diagnosis between the forms of Group II is easy, but the catarrhal is hard to distinguish from the gonorrhœal metritis. The presence of gonococci is pathognomonic; in their absence the clinical history must furnish the decisive details. The ordinary "catarrhal" metritis, such as results from excessive venery, onanism, and displacements of the uterus, is not an inflammation but simply a hyperæmia which disappears when the cause is removed.

The position assumed by Bäcker is that entertained by Pozzi and numerous other modern writers and pathologists; and it is the view upon which the discussion of infection will be based in this work. The terms *endometritis* and *metritis* will both be employed; the former, in particular, because it designates inflammation of the lining membrane of the uterus, to whatever extent the myometrium also may be involved. It is convenient for the purpose of designating inflammatory processes of the uterus since the most important phenomena of them are manifested upon its internal surface.

The ground upon which endometritis should be considered as a mixed infection is firmly established. Brandt found pathogenic organisms in 31 per cent of his cases of endometritis. Other observers have found them in larger proportions of cases. The fact that Brandt's cases embraced both acute and chronic endometritis favours the doctrine of a bacterial causation in a much larger percentage of the acute cases than was demonstrable; for, as is well known, bacteria within the uterus are relatively self-limiting, while the pathologic changes which they induce may continue. It follows from this, that in many cases of so-called chronic endometritis in which no bacteria can be demonstrated, the organisms have disappeared by process of self-limitation.

The **pathologic changes** that are induced by an acute mixed infection are simply those characteristic of an acute inflammation in the mucous membrane. There is an immediate turgescence of the sub-

Fig. 146.—"The stage of inflammatory exudation is speedily reached."—Reed.

epithelial capillaries, with a consequent overstimulation of glandular activity. The influence of the micro-organisms or of their toxines is such as to destroy, in some cases, the superficial epithelium in the more exposed area, while the germs themselves penetrate deeply into the mucous folds and the utricular follicles. The stage of inflammatory exudation is speedily reached (Fig. 146), and differs from the same

stage of inflammation in other tissues in the fact that there is no underlying submucous connective tissue to become the receptacle of the transuded liquor sanguinis and the migrated cellular elements of hematogenous origin. The exudation on the other hand takes place, at least, to an important degree, directly among the fibrillæ of the myometrium. In exceptional cases, however, the exudation takes place more distinctly between the mucous membrane and the muscularis, with the result that the former is sometimes separated, in part at least, from the latter. It is this condition that occasions severe dysmenorrhœa. Winter asserts that it is the origin of some cases of dysmenorrhœa of the membranous variety. The sero-albuminous deposit gives to stained sections an appearance more transparent than is observed in the normal mucous membrane. The changes incident to resolution now manifest themselves in the disappearance of the liquid elements of the exudate, and in the migration of the leucocytes toward the surface or into the minute lymphatics, until presently both the cellular and the noncellular elements of the exudation have disappeared. In many cases, however, in consequence of the peculiar structure of the endometrium, there exist within the deep follicles bacterial elements, which, modified in their virulence, perpetuate in a lesser degree the original inflammatory changes. The persistence of this irritation is sufficient, not only to prevent the resorption of the exuded elements, but to effect their continued deposition and organization. The result is a distinct hyperplasia, characterized by an increased thickness of the mucous membrane. A section of the mucosa reveals that it is of increased depth, while its cellular elements are not only relatively but absolutely increased in number. The leucocytes are found in some cases in large interstitial deposits, while the blood vessels themselves show but slight thickening of their walls. As a result of these interstitial deposits increased pressure is exercised upon the glands which now seem smaller and relatively fewer in number. In this stage, bacterial elements have generally disappeared from the secretion, the withdrawal of their influence resulting in the more or less speedy supervention of the next stage of the process; this is characterized by an absorption, to a certain degree, of the remaining free elements of exudation, but without any material diminution in the number or size of the hyperplastic products. These, on the contrary, continue to exercise pressure upon the already compressed glands which now undergo atrophy; or, as may happen, an efferent duct may become occluded and the underlying follicle thus become converted into a retention cyst. Some of the glands, instead of being at right angles to the mucous surface, as under normal conditions, become oblique, and the stroma is characterized by increased density, and, on section, shows cells that have become elongated and arranged in bundles and fasciculi. The changes that are now presented are very much like those observable in the senile uterus. In these cases there is generally diffuse sclerosis of the muscularis.

The most ordinary, and more or less persistent, change following an acute infection of the uterus is that of *glandular hypertrophic endometritis.* In this form the cellular changes are restricted chiefly to the epithelium, the cells of which undergo, not only hypertrophic, but hyperplastic changes. The result is essentially one of increased glandular development, with corresponding increase of functional capacity. The glands seem to be increased in size and number and to be studded more closely together than in normal conditions. The exuberance of epithelial cell growth results in an apparent thickening of the endometrium, which now appears to be arranged in slight folds, on the apices of which, more distinctly than elsewhere, the cell development seems to be luxuriant. On section, the mucous glands, instead of being straight tubules projecting downward into the stroma, are found to be tortuous, or, in other cases to show simple deviation in axis. On cross section their calibres are found to be widened, their lumen being largely occupied by the exuberant cell growth. In this class of cases the lumen of the mucous gland often becomes so distended with newly formed epithelial elements that the latter project from the ostium and appear upon the surface with a sort of granulation. In the more distinctly hyperplastic varieties, there seems to be not only an increase in the number of the tissue elements, but a multiplication of the glands themselves. These glands increase in size and number, and sometimes show a marked increase in the interglandular stroma. The exuberant cell growth in these cases results in a thickening of the mucous membrane, the surface of which presents a fungous appearance. It is for this reason that the condition is sometimes called fungous endometritis. As the epithelial cells develop from the matrix there is demonstrable a certain proliferation of the sanguiniferous capillaries to give them support. The cell growth is, however, so active that it gets beyond the influence of the nutrient supply and undergoes fatty degeneration. When this occurs, the terminal filaments of the newly proliferated vessels are exposed, and hemorrhage results.

It is sometimes important to distinguish areas of glandular hypertrophy occurring upon a limited area of everted cervical membrane, from syphilitic infection. In the first place the primary syphilitic sore of the portio vaginalis is rare, and when it occurs it is manifested by a distinct erosion, ulcerative, with sharply defined borders. It is in nearly every case associated with induration of (1) the intrapelvic lymphatics, and later (2) those in the inguinal regions. Chancroids are liable to be overlooked, as they are generally painless and, aside from an offensive discharge, produce no symptoms.

The **causes** of endometritis may be summarized in the general word *infection.* There are, however, numerous conditions which seem to contribute to this infection. As has been shown by Sinclair, the uterine cavity from the os externum to the fundus is normally free from bacteria. When infection occurs above the external os it must be as

the result of the carriage thither of the infectious element. The use of instruments to produce abortion, and the employment of the uterine sound for more legitimate purposes, may be held responsible for a large number of cases. The use of an unclean speculum is a reasonable explanation of the infection of the upper portion of the vagina, whence the infection may extend by progressive invasion of the mucous surfaces to the endometrium. Pessaries, for the most part unclean and stinking things, are to be looked upon with more than suspicion. The use of an unclean syringe nozzle is dangerous. There are certain physical conditions of the uterus that are undoubtedly predisposing causes of infection. Laceration of the cervix, by exposing a portion of the endocervium to the infectious elements that abound in the vagina, may pave the way for a more general involvement. Schultze has called attention to the influence of a chronic dilatation of the cervix in favouring the introduction of morbific agencies into the uterine cavity. Prolapsus of the uterus, when complete, is generally associated with more or less infection of the endometrium. Uterine displacements in general may be looked upon as contributory influences in producing the pathologic states which are found in patients with associated demonstrable infection.

Neoplasms of the uterus, particularly when they have become the seat of retrogressive changes, are a source of infection. Abel and Landon, after making numerous careful microscopic studies, arrived at the conclusion that in cases of cancer of the cervix the corporeal endometrium undergoes marked changes—especially of an inflammatory character.

Acute infectious diseases have been looked upon as causes of endometritis. Massin of St. Petersburg (*Archiv für Gynäkologie*) made an effort to settle this question by conducting a series of experiments upon eighteen cases. Of these, twelve were cases of relapsing fever, two of pneumonia, two of enteric fever, one of dysentery, and one case of acute general peritonitis of unknown causation. The uterus, with the adnexa, was removed at the autopsy and placed in Müller's fluid, and allowed to remain therein from a month to six weeks. Sections were made from different portions of the uterine walls, including the os internum and cervix. They were first kept in alcohol (70 per cent), then placed in absolute alcohol for one week, and then in photoxylin solution. The sections were stained with borocarmine, picrocarmine, eosin, and methylene blue. From an examination of these specimens the following conclusions were arrived at: " The mucosa is affected in all of these acute infectious diseases, as are the glands, the vessels, and the uterine muscular fibres. Firstly, they are all markedly injected. The injection may be marked in one portion of the mucous membrane, or, as was usually the case, may affect the entire mucous membrane. The increased size of the vessels was especially noted in the small veins and capillaries. The arteries were empty, and in only a few cases did they contain formed blood elements. In many cases the dilatation was so

great as to cause a rupture of the vessels, and consequently hemorrhages into the mucous membrane and between the muscular layers. These ecchymoses occurred in cases irrespective of the age of the patients. The most marked cases of dilatation and rupture were those in which the disease had been continuous, as in the cases of pneumonia and enteric fever, whereas in the cases of relapsing fever hemorrhages were only found in half of the cases. Next, in reference to the glands. The epithelium lining these was always swollen and cloudy, having rounded edges; the cells were coloured with difficulty. The epithelial cells secreted more mucus than normally. In some cases the glands were markedly enlarged. In many cases the epithelium was detached from the glandular tissue and lay in irregular masses in the glandular cavities. The membrana propria of the glands and the surrounding layer of spindle-shaped cells were well marked in nearly all of the cases. We frequently observed new-formed granular elements, which were arranged around the glands in the form of a belt. The muscular layer of the uterus did not seem to be much affected by the disease. As stated above, the vessels in the muscular layer were injected. The changes which we observed represent a parenchymatous and interstitial inflammation of the mucous membrane and an interstitial inflammation of the muscular layer. Furthermore, in all of the cases a condition was observed which can be termed a hemorrhagic endometritis. We naturally conclude, after having made these experiments, that the endometritis undergoes three processes: 1. Increased amount of blood to the uterus, venous stasis, and inflammation of the vessels; 2. Granular inflammation; 3. Diffuse spreading of this inflammation. In our experiments we were unable to ascertain whether micro-organisms were present or not. We must, therefore, consider acute infectious diseases as important factors in the causation of uterine diseases, so that when we consider the etiology of acute and chronic endometritis we must always think of the possibility of the affection being the result of an acute infectious disease."

The **symptoms** of endometritis vary somewhat according to the pathologic changes upon which they depend. In the simple infections of the endometrium involving only the superficial epithelium and the mucous follicles, there occurs a discharge ordinarily designated as uterine leucorrhœa. This discharge is generally clear and viscid and is occasionally stained with blood. It is sometimes of a distinctly muco-purulent character. Schultze, recognising the fact that purulent elements may be so slight in the uterine discharge as to escape detection, advises the use of a glycerine tampon for diagnostic purposes. The tampon should be removed by the surgeon, who should carefully inspect it and thereby ascertain with accuracy the presence or absence of purulent elements. In cases of long standing, frequent hemorrhages, occurring either in connection with menstruation or during the intermenstrual period, are to be construed as evidences of fungous degeneration of the endometrium. There may or may not be dysmenorrhœa,

and the uterus may or may not be enlarged. The cervix in the majority of cases is, however, the seat of more or less engorgement or infiltration, or may even be œdematous. In some cases the uterus may be painful, a condition which Sneguireff of Moscow designates as endometritis dolorosa. Sensibility of this character is generally more marked at the fundus.

The **diagnosis** depends not only upon the symptomatology, but especially upon the demonstration by microscopic and bacteriological examination of bacterial elements in the uterine secretion. If the endometrium is everted at the cervix and presents a granular appearance the case is one of glandular hypertrophy. If hemorrhages are present there exists a strong suspicion of endometritis fungosa. It should be remembered, however, that hemorrhage is a conspicious symptom of various malignant processes, not only of the cervix but of the corpus uteri. (See Symptoms of Malignant Neoplasms of the Uterus). In view of these facts and under these circumstances it is imperative that the uterine cavity be explored. The cervix should be dilated. This is done preferably by some of the mechanical dilators, such as Palmer's convenient device; or, as preferred by Sinclair, a carefully sterilized laminaria tent may be then employed. The chief objection to the latter is the time and discomfort involved in its use. Dilatation should be carried to a degree that will admit of the easy introduction of a curette or of a curette forceps. Either one or the other of these instruments should then be inserted and by gentle scraping some of the intrauterine tissue should be removed. This should be carefully preserved and examined microscopically. Gessner (*Zeitschrift für Geburtshülfe u. Gynäkologie*) in a careful discussion of the technique of exploratory curettage states that anæsthesia is useful although not indispensable. The dilatation is to be carried to a degree that will admit of the introduction not only of the curette, but subsequently of an irrigation catheter. A sharp curette is to be employed and the whole interior of the uterus must be carefully scraped and every fragment so removed must be examined under the microscope. Unless this precaution is taken, evidences of malignancy which may be derived from a very limited area may escape detection. Sänger recommends that the uterine canal be dilated by means of laminaria tents until not only a curette, but also the finger, can be introduced into the uterine cavity. He states that in those affections of the corpus in which malignancy is always to be suspected, the use of the curette is superior to simple palpation, but palpation with curettage and microscopic examinations of any *débris* that may be removed will give more information than the two latter only. While Sänger insists upon this technique in cases of abortion and of myomata of the corpus uteri, he recognises in digitation a valuable diagnostic expedient in certain enlargements of the uterus associated with involvement of the endometrium. Gessner, in speaking of the diagnostic value of exploratory curettage, states that in the *Frauenklinik* of the University of Berlin, a diagnosis of

malignant disease of the corpus uteri had been made and the organ had been extirpated in fifty-eight cases during a few years. In eleven, carcinoma could be distinctly felt through the dilated cervix; in three others in which the finger could reach the new growth the disease was found to be sarcoma. In forty-one cases, however, the diagnosis was made, not by digitation, but by exploratory curettage. He looks upon the latter as the more valuable expedient. When the scrapings are examined the diagnosis will be established by their resemblance to the histopathologic appearances already described.

The **treatment** of endometritis must depend somewhat upon the particular pathologic condition that may be presented at the time. In the simple catarrhal forms, in which the most annoying symptom is a persistent leucorrhœa, reliance is often placed upon *topical remedies*. As has been shown in the discussion of the pathology of this condition, there exist such organic changes that any results that may follow the use of local medication must be at best slow and uncertain. It may be stated as a rule that intrauterine medication for catarrhal conditions is unsatisfactory. There are patients, however, who prefer to be treated locally for a long time rather than to submit for a few days to anything suggestive of surgical intervention. In these cases treatment should consist in the use of bactericidal agents. These should be so applied that the entire mucous surface should be subjected to their influence; for, if a portion of the mucous surface remains untreated, and consequently infected, it becomes the focus for the reinfection of the entire structure. Another principle of equal importance is, that an intrauterine application of a bactericidal character should be repeated or maintained for several days, so that, not only the bacteria themselves, but their spores also will be destroyed. There is probably nothing in the whole range of gynecological therapeutics that is so futile, not to say farcical, as the repeated applications to the cervical membrane of various medicaments of undetermined antiseptic value, and many of them of unknown ingredients. As a rule these applications are made to a canal bathed with tenacious mucus, which of itself constitutes an efficient protective for the underlying micro-organisms. Topical treatment, to be effective, must be brought into direct contact with the micro-organisms. These, as already described, are hidden away within the epithelial folds or deep down in the mucous follicles. The tissues themselves, both epithelial and subepithelial, are more or less hypertrophied; an agent, therefore, which will be effective must modify this histologic state. Most practitioners have, therefore, abandoned the use of nonescharotic agents. Those that are employed, however, are not viciously destructive of the tissues like nitric acid or sulphuric acid, or pure formalin. *Reed's method* of treating these cases is as follows: The cervical canal is dilated, if necessary, to a very slight degree by means of a Nott or other small dilator. The posterior lip of the cervix is seized with a volsella or the serrated cervix forceps of Dumont-Lelois and held by slight downward traction. The uterine

cavity is then packed with a very slender ribbon of dry sterilized gauze; this is immediately withdrawn, bringing with it all the mucus from the endometrial surface. If a first packing is not satisfactory for this purpose, a second may be utilized. After the mucous surfaces have thus been carefully cleansed, the uterine cavity is again packed with a slender ribbon of gauze saturated with 98-per-cent carbolic acid. This is left *in situ*. In applying the carbolic acid it is important to avoid bringing it in contact with the integument of the mucous membrane of the vagina; but if this accident should happen, the place should be immediately touched with pure alcohol, which will neutralize the carbolic acid. A tampon of glycerine or of boroglyceride is applied and the patient is permitted to go home, returning in forty-eight hours for a repetition of the treatment. Three or four applications of this kind, made at lengthening intervals during ten days, are generally sufficient to cure an ordinary case of catarrhal endometritis. The treatment, contrary to usual theoretic preconceptions, is not particularly painful and never requires an anæsthetic. The destruction of epithelium from these repeated applications is not sufficient to interfere with its speedy reproduction. Cases have been reported in which cures have been effected by the introduction into the uterine cavity of a piece of lunar caustic, which was permitted to dissolve *in situ*. The uterine cavity has been packed with boric acid and with iodoform, both of which have some bactericidal properties. Canquoin has reported successes from the intrauterine application of a paste the essential ingredient of which is the chloride of zinc. It is prepared in the form of a pencil and is introduced into the uterus; Pichevin, Emmet, Schröder, Martin, Mundé, Jacobs, and others, have reported adversely on its use, and it seems to have been discontinued. As an escharotic agent, the chloride of zinc is vastly more destructive than even the silver nitrate, the use of which has been very generally abandoned.

Sneguireff recommended the action of steam upon the inner surface of the uterus as a means of arresting intrauterine hemorrhage, and it has been quite extensively employed, especially in Russia. Its application requires a steam generator with a safety valve and with a central opening for the insertion of a thermometer, the generator being connected by rubber tubing with a metal catheter of necessary length for intrauterine application. The temperature should be kept between 100° and 110° C. (212° F. to 230° F.). A Fritsch uterine irrigator may be used for the application of the steam. The patient is placed in the lithotomy position, and a short cylindrical speculum of some nonconducting material, such as celluloid or hard rubber, or preferably wood, is inserted. A catheter is then inserted and the steam is turned on. The instrument should be encircled with gauze, or provided with a nonconducting handle, to avoid burning the hands of the operator. The patient should remain in bed for a few days. There is generally considerable reaction with pronounced perimetric irritation. It has

been recommended by Pincus for senile endometritis with profuse hemorrhage or leucorrhœa; where irregular hemorrhages are associated with subinvolution of the uterus; for diffuse myomata; for hyperplastic or catarrhal endometritis; and for gonorrhœal and streptococcous infections of the uterus. It must not be used in the presence of diseased adnexa or in cases of stricture of the cervical canal, while it is not advised in polypoid myomata. This method is spoken of as vaporization, but it is really a cauterization with extensive destruction of tissue. It is possible that the principle may survive, although the present technique seems to be defective. The use of superheated steam destroys tissue to a depth that is dangerous. Baruch reports a case of atrophy of the uterus with occlusion of the cervical canal and apparently of the whole uterine cavity, following vaporization in a woman only twenty-seven years old. This condition amounting to the practical destruction of the uterus was induced by a single intrauterine application of steam for the purpose of checking puerperal hemorrhage, an object which was speedily accomplished. Von Guérard (*Centralblatt für Gynäkologie*) reports the case of a woman who had persistent hemorrhages following delivery, with evidences of subinvolution of the uterus and fungous degeneration of the endometrium. Atmocausis, as this method of vaporization is called, was employed. There was a cessation of the menses following the operation, but at the menstrual periods unendurable pains were felt, becoming intensified as time went on. The uterine cavity was so obliterated by the steam jet that the sound entered it for about 2 centimetres only. Von Guérard was forced to relieve the patient by a total hysterectomy, from which she recovered. In commenting upon the case, he insists that atmocausis was absolutely contraindicated before the menopause. Schick, of Prague (*Centralblatt für Gynäkologie*), recognising the valuable property of heat for antiseptic and hemostatic purposes and as an escharotic agent, has endeavoured to secure its desired effect by the use, not of superheated steam, but of boiling water. He kept up the irrigation for half a minute, only the vagina and vulva being protected by constant irrigation of ice-cold water. Of the four cases in which he tried it three were successful. While this treatment may be of great value, its employment is certainly associated with great danger, and it is mentioned in this connection only with the hope that the valuable principle which it embodies may find safe exemplification in more refined methods.

It may be stated, as a rule to which there are no exceptions, that in all cases of infection of the uterus in which the condition has assumed the chronic form with associated histologic changes, the topical application of any medicament, escharotic or otherwise, is less satisfactory than curettage followed by appropriate antiseptic treatment.

Curettage of the Uterus

Instruments for Dilatation of the Cervix and Curetting of the Uterus

Catheters, glass (Fig. 147)..... 1
Catheter, irrigating two-way, small... 1
Curette, sharp (Sims's modified)..... 1
Martin's blunt, double..... 1
Martin's sharp (Fig. 148)..... 1
Dilators, Palmer's medium.
Hegar's, 4 sizes (Fig. 149).
Goodell-Ellinger.
Forceps, Bozeman's long dressing (Fig. 150)..... 1
Rat-tooth..... 1
Forceps, bullet..... 2
Serrated cervix forceps of Dumont-Leloir (Fig. 151)..... 1
Nozzle, Edebohls's..... 1
Packer, vaginal..... 1
Sound, uterine..... 1
Speculum, Jones's (Fig. 152)..... 1
Sims's small..... 1
Simon's, with handles and four blades (Fig. 153)..... 1
Tenacula (Fig. 154).

In those varieties of intrauterine infection resulting in the development of fungous granulations with associated hemorrhage, intrauterine medication of whatever sort is futile. The only available remedy consists in the removal of the adventitious tissue. Patients who are the victims of hemorrhage, and are consequently greatly reduced in strength, are generally less persistent in urging objection to the slight surgical procedure of curettage. This, with associated antiseptic measures, is distinctly the most valuable means of treating infections either acute or chronic, either mixed or specific, of the endometrium; while if not followed by antiseptic measures it is a worthless and dangerous expedient. The *uterine curette*, according to Pozzi, was invented by Récamier, after which it fell into discredit. J. Marion Sims did much to re-establish the instrument in favour, while Thomas Roux and the elder Martin have been instrumental in defining its uses and limitations. The curettes, as now found, vary in size and form; some of them are dull wire loops, bent at various angles; others are spoon-shaped, some with dull and some with sharp edges; some are steel loops with sharp edges, while others, like that recently invented by Gau (Fig. 144), are provided with a safety end, and yet can be used as either a sharp or a dull instrument. All of them are found illustrated in the instrument makers' catalogues. The object of the curette is to remove adventitious tissue from the uterine cavity or cervix. The method of its employment does not differ from that already described in connection with exploratory curettage as a means of diagnosis in endometritis (*ante*). As a matter of fact, curettage, whether undertaken for diagnostic or other purposes, should always be conducted with the same antecedent and sequent precautions. The same rigorous antisepsis should precede the operation, the interior of the uterus should be treated in

Fig. 147. Glass catheter. —Robb.

Fig. 148. Martin's sharp curette. —Robb.

precisely the same way, and the operation itself should be just as extensive when undertaken for diagnostic as for other purposes. It may be accepted as an axiom of practice that the existence of any condition demanding the use of a curette can be determined by macroscopic appearances; while the more refined diagnosis may be based upon subsequent examination of the scrapings.

The first *contraindication* of curettage is nonexperience in uterine surgery on the part of the operator. There is probably no manipula-

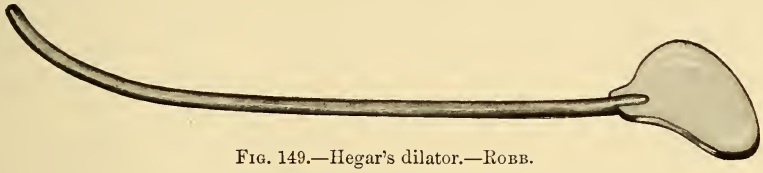

Fig. 149.—Hegar's dilator.—Robb.

tion in surgery for the proper practice of which more dexterity, more deftness, or more of that judgment which depends on the *tactus eruditus*, is demanded than curettage. Among other contraindications, summarized by Currier (*International Journal of Surgery*), are ignorance on the part of the operator of the exact limits and outline of the uterine cavity; the presence of the menstrual flow; extreme displacements of the uterus; and acute infectious diseases of the uterine appendages. Polk (*New York Journal of Gynecology and Obstetrics*) takes the ground that curettage is an eligible operation in cases of chronic metritis associated with salpingitis, asserting that, when prop-

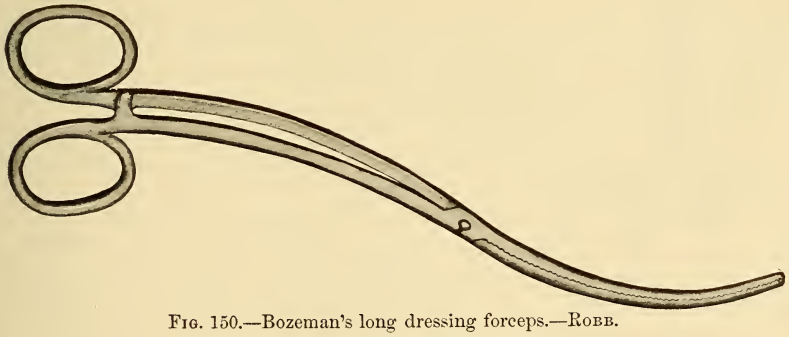

Fig. 150.—Bozeman's long dressing forceps.—Robb.

erly done, it affords much-needed depletion to the uterus and is not followed by peritonitis or acute salpingitis; and in support of his statement presents a tabulated list of forty cases giving the maximum diurnal temperature for eleven days following the operation. It is certainly a gratifying exhibit showing but trifling and evanescent reaction, and that only in a few cases. But gratifying as these facts are, they can not be accepted as demonstrating the safety of curettage in the presence of inflammatory conditions, whether acute or chronic, in which pus, although in undetectable quantities, is liable to exist

in the uterine appendages. The necessary traction and vigorous manipulation essential to a thorough curettage is liable to produce cleavages in adhesions and consequently to liberate previously confined pus.

Objection has been urged against the use of the sharp curette upon the ground that it destroys the epithelium which is replaced by cicatricial tissue. This objection is not tenable unless the operation amounts to a practical endometrectomy involving the complete removal of the basis membrane of the endometrium. As has been shown by Von Kohlden and others, there occurs physiologically in connection with the menstruation a periodical loss of epithelium. This physiologic function may be carried to the pathological degree involving the shedding of the entire membrane. (See Membranous Dysmenorrhœa). When this occurs, however, the membrane is again speedily reproduced. Bossi has studied the reproduction of the mucous membrane of the uterus, following its apparent complete destruction by Canquoin's paste of the chloride of zinc. From his observations and a more or less thorough investigation of the question, he has arrived at the following conclusions (*Nouvelles archives d'obstétrique et de gynécologie*, December, 1891): 1. The mucous membrane of the uterine body in the bitch, abraded by free cuts of the bistoury extending through its whole thickness, is reproduced in its integrity, that is to say, with a formation of true glands. 2. Reproduction takes place slowly, and sometimes, by reason of conditions not well determined, is subject to considerable retardation. 3. The covering epithelium, which primarily extends over the wounded surface, derives its small glands from the borders of the cut. 4. The newly formed glandules derive from the proliferation of cells a new covering epithelium when it has acquired the cylindrical form.

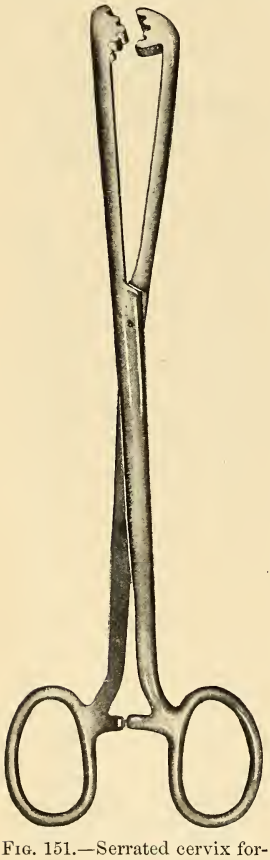

Fig. 151.—Serrated cervix forceps of Dumont-Leloir.

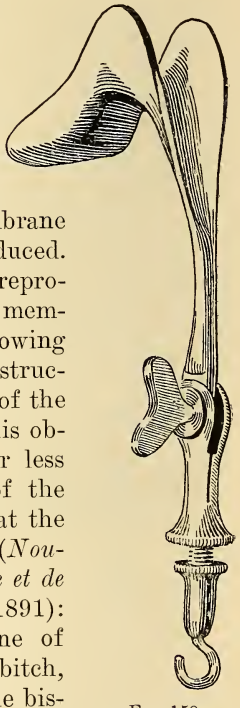

Fig. 152. Jones's speculum.

As a final word on curettage in the treatment of endometritis, let

it be said that the mere scraping away of inflammatory products is curative to that extent and to that extent alone; that if the treatment stops at that point it will be worthless; that curettage is not necessary in the many cases, even to remove these inflammatory products; that its value consists in removing those tissue elements which serve as hiding places for the morbific micro-organisms; and, finally, that the *essential element* of the treatment consists in the thorough

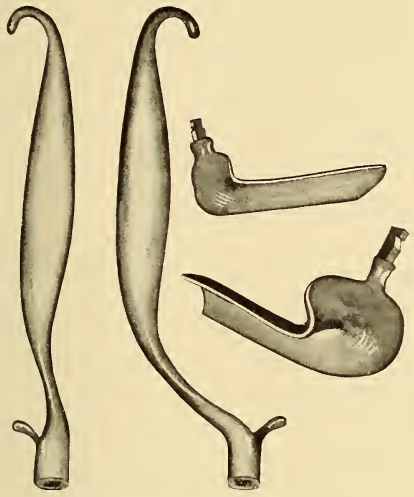

Fig. 153.—Simon's speculum.—Robb.

Fig. 154.—Tenaculа.—Robb.

application of antiseptic agencies to the denuded endometrial surface. Curettage is, therefore, but a part, although a very important part, of a plan of treatment which has for its object, not alone the removal of pathologic products, but the destruction of the causative bacteria and their spores.

CHAPTER XXVII

INFECTIONS OF THE UTERUS (Continued)

Specific: Gonococcous infection (gonorrhœa)—Streptococcous infection (puerperal fever)—Tuberculous infection (tuberculosis): of the cervix: of the corpus—Syphilitic infection (syphilis)—Echinococcous infection (hydatids).

Gonococcous infection of the uterus is simply an upward extension of gonorrhœa from the vagina. This rarely occurs spontaneously, because of the resistance offered, first, by the mechanical arrangement of the vagina, and next, by its secretions and its normal bacteria, notably, the acid-secreting bacillus of Döderlein. (See Gonorrhœa of the External Genitalia.) Extension to the uterus in the majority of cases is the result of mechanical intervention in some form. As pointed out by Rosenwasser, it often results from meddlesome treatment of the disease when limited to the vulva. Some physicians proceed upon the mistaken theory that the vagina is the primary seat of infection of gonorrhœa in woman, and begin at once to treat that canal with mistaken vigour. The ordinary result of such interference is to establish the very condition which it is desired to overcome. It must be admitted, however, that in the majority of cases, the patient herself, rather than her physician, is responsible for the extension of the infection. The practically universal use of the vaginal douche results in these cases in mischievous complications.

Schultze investigated two hundred cases with the result that he disproved the accuracy of Broese's opinion that the uterus is infected in every case of gonorrhœa in women. Schultze further concluded that gonorrhœa is infectious only until the gonococci have disappeared from the secretion, whether the latter is vitreous or purulent; he found that when the cervical secretion contains no gonococci there are none in the secretion from the cavity of the uterus. The secretion was purulent in a trifle over 50 per cent of the cases, while in the rest it was vitreous and merely turbid, the latter conditions not excluding the existence of gonococci. The gradual upper extension of the infection was indicated by the fact that even when the cervix was involved, the uterus showed contamination in only 38 per cent of the cases. The adnexa suffered in 38 per cent of those with cervical gonorrhœa, and in 45 per cent when the uterus also was infected. Van Schaick (*New York Medical Journal*) made a study of gonorrhœa

in married women and found gonococci existing as at least complicating causes of leucorrhœa which apparently depended upon cervical lacerations.

The *symptoms* of gonococcous infection of the uterus do not differ materially from those which have been described in connection with the recognised mixed infections. (See Endometritis.) The diagnosis, however, depends upon the demonstrated existence of the gonococcus; with the gonococcus present there is gonorrhœa; without it there is no gonorrhœa. Neisser observes that many cases of undoubted gonorrhœa would escape recognition if clinical evidences, alone, were relied upon. The gonococcus is not always easily found. Van Schaick, in a careful examination of sixty-five women, found gonococci seventeen times, or in 26 per cent of the cases. Nineteen women were examined twice, and in three, gonococci were found at the second examination. Thirty-two were examined three times, and in three of these the third examination revealed the presence of the micro-organisms. It is of importance in this connection to note the conclusion of Broese and Schiller (*Berliner klinische Wochenschrift*) that the intercellular arrangement of gonococci is not to be recognised as pathognomonic of acute gonorrhœa, since they have repeatedly found them outside the cells. The *diagnosis* of chronic gonorrhœa, these observers contend, may be based upon the characteristic shape and size of the gonococci, and upon their reaction to the Pick-Jacobson method of staining. The history of a previous acute attack of vulvar and urethral gonorrhœa, particularly if treated with douches and tampons, is a clinical factor of conclusive diagnostic importance. In the puerperal state, gonococcous infection of the uterus is manifested by an increase in the volume of the lochial discharge, which becomes purulent but not necessarily offensive. The purulent character of the lochia is observed as early as the fourth day after delivery. Krönig has observed a temperature of 104° F., or more, resulting from these germs in the uterus. The occurrence of ophthalmia neonatorum in the child is a confirmatory evidence of gonorrhœal infection. The final diagnosis, however, depends upon the demonstration of the characteristic micro-organisms in the lochia.

The *pathology* of gonorrhœal infection of the uterus has but few points at variance from that of the other infections. It would seem that the micro-organism reaches the cervical mucosa in a condition of reduced virulence, but sufficiently potent to cause the usual inflammatory phenomena. Its behaviour in the endometrium does not differ materially from that in other mucous membranes. In the acute form the micro-organisms may or may not penetrate the cells, and, as has been already stated, their extracellular existence is not inconsistent with true gonorrhœal infection. If the infection is received during the course of pregnancy it is liable to cause miscarriage, with a probable upward extension of the disease to the Fallopian tubes, as has been demonstrated by Wertheim. Madleur (*Centralblatt für Gynä-*

kologie) has shown that in the puerperal state gonococci may penetrate the muscularis and cause parenchymatous suppuration; and that from this point the infection may reach the system through the lymph channels and cause arthritis, endocarditis, etc. In these cases, however, the infection is probably associated with, if not dominated by, *Streptococcus pyogenes*. Leleneff (*Wiener klinische Wochenschrift*) has confirmed the observations of Madleur, as he has demonstrated the gonococci between the bundles of muscular fibres. He states, in addition, that the destructive action of the gonococci upon cellular protoplasm causes the latter to degenerate and liquefy, leaving only a feebly staining vacuolated nucleus. In view of the fact that these changes have been observed alike in those cells which contain the gonococci and those which do not, it is assumed that the destructive action must be due to some toxines produced by the gonococci. The widely credited power of gonococci to penetrate the leucocytes is confirmed, while it is also demonstrated, contrary to previous opinions, that they invade squamous as well as columnar epithelium, and that it is by virtue of this fact that they find their way into the deep structures of the uterus.

The *treatment* of the acute stage should be conducted with reference to avoiding unnecessary diffusion of the infection. As has been shown by observations already alluded to, infection may exist in the cervical canal without its extension to the corpus uteri. This fact is to be held in mind in the adoption of treatment. The cervical canal should be thoroughly cleansed and treated with protargol, a proteid compound of silver. Neisser looks upon this agent as an efficient antigonorrhœal remedy, which, if employed at an early period, exerts a prompt and favourable influence upon the course of the disease. In most cases it arrests all acute manifestations, causing rapid disappearance of the secretion and the gonococci, and preventing the extension of the disease. Salochin has used this remedy in a 5-per-cent solution applied through a speculum to the cervical canal. The vagina was treated with a 2-per-cent solution, and a tampon moistened with it was left in position. The solution made by Colombeni is as follows: Ten grammes of protargol are placed in a small mortar to which are added 5 cubic centimetres of neutral glycerine, the two being stirred together with a glass rod till a thoroughly homogeneous moist paste is produced. This is next diluted with 95 cubic centimetres of cold sterilized water, and shaken up till a perfect solution is produced; this solution is kept in a coloured bottle in a dark place. As required, a 0.25-per-cent solution is made by mixing 2.5 cubic centimetres of the standardized solution with 97.5 cubic centimetres of sterilized water; a 0.50-per-cent solution by mixing 5 cubic centimetres with 95 cubic centimetres of water; a 1-per-cent by mixing 10 cubic centimetres, and a 2-per-cent by mixing 20 cubic centimetres of the standardized solution with 90 and 80 cubic centimetres, respectively, of sterilized water. A very good way

to use the Colombeni solution is to saturate a ribbon of sterilized gauze with it and insinuate it into the uterus. The uterine packing at this time, whether of protargol, pure carbolic acid, or pure lysol, exercises a profound bactericidal influence, and does not carry the infection upward into the uterus, for the reason that any micro-organism that may come in contact with the saturated gauze will be destroyed. The gauze should be removed after forty-eight hours, and should be replaced after an interval of another forty-eight hours. In cases of chronic gonorrhœal infection of the uterus, the cocci have found hiding places in deep folds of the endometrium, whence the disease has been looked upon by some observers as self-limiting, while others with equal emphasis insist that it is more or less constantly revived. It is a matter of clinical observation that in these cases there occur periods of quiescence, followed by exacerbations that are not induced by fresh infections.

Jadassohn (*Correspondenz-blatt für Schweizer Aerzte*) asserts that chronic gonorrhœa in certain cases may become acute through superinfection with their own cocci. He reaches this conclusion notwithstanding the observation of Wertheim, that a mucous membrane affected with chronic gonorrhœa did not react to cultures taken directly from it, although it reacted to cultures taken from another patient.

The mucous membrane does not become so used to the presence of the cocci that the latter can live as saprophytes on it after the tissue has become normal. On the contrary, the inflammation remains for a time after the infectious elements have disappeared. He concludes, also, that chronic gonorrhœa may become acute, not only through the increase of its own gonococci, but by reinoculation from another person. While there are instances in which the membrane does not react to inoculation with gonococci from any source whatever, they are to be looked upon as exceptional, and the generally entertained theory, that the mucous membrane that has been the seat of a chronic gonorrhœa thereby acquires immunity, is to be abandoned. It is not proper, therefore, to look upon chronic gonorrhœa of the uterus as a self-limiting disease, but rather as one that is capable of indefinite perpetuation. Treatment should, therefore, be directed to the eradication of the infection, which, if left to itself, will, in at least 50 per cent of the cases, extend upward into the Fallopian tube. If this has not already taken place, and if there is no acute infection in the adnexa or other perimetric structure, curettage should be practised. (See Curettage.) The treatment should in no wise differ from that already prescribed for chronic infectious endometritis, with the exception that it is better to select some distinctly antigonorrhœal remedy, such as protargol, carbolic acid, or lysol, with which to pack the uterus after its cavity has been scraped. This is not a dangerous procedure when done skilfully and under proper antiseptic precautions, all alarmist declarations to the contrary notwithstanding.

Streptococcous Infection.—Puerperal fever is the ordinary clinical manifestation of uterine infection by the *Streptococcus pyogenes*—otherwise known as the micrococcus of erysipelas, *Streptococcus erysipelatos*, *Streptococcus longus*, etc. (See Streptococcus Pyogenes.)

As elsewhere stated, Oliver Wendell Holmes was the first to direct attention to the relationship of cause and effect between erysipelas and puerperal fever, an observation which was confirmed by Stillé, who reported ninety-five cases of puerperal fever occurring in rapid succession in the practice of a single physician in Philadelphia, in which fifteen of the children died from erysipelas. Fehleisen was the first to demonstrate that the *Streptococcus pyogenes* was the essential micro-organism of erysipelas. That this same micro-organism is the *materies morbi* by which the parturient woman is infected with resulting puerperal fever is supported by cumulative evidence. Clivio and Monti demonstrated its presence in five cases of puerperal peritonitis; Widal found it in sixteen; Czerniewski found it in the lochia of thirty-five out of eighty-one women with puerperal fever. Bumm was able to find the streptococci alone in five cases (three of these ending fatally). In twelve cases, besides the streptococci, there were observed upon the plate cultures staphylococci and other germs. In eight cases the number of germs of decomposition were very great (mixed form of septic and putrid endometritis). Two of these cases terminated fatally, the streptococci entering the venous thrombi at the placental site and a pyæmia resulting.

Occasionally we may find pyogenic staphylococci, especially the aureus, besides the streptococci. Bumm only observed staphylococci alone in two cases. The cases were mild ones, and this coincides with the observations of Fehling.

The *pathology* of infection by the *Streptococcus pyogenes* is typically manifested in the uterus. This micro-organism, introduced into the vagina by the finger of the accoucheur or upon instruments employed in delivery, finds in the fluid contents of the uterus a congenial culture medium in which it propagates with great rapidity. The placental site serves as an enormous infection atrium, the wide, distended lymphatics and the open blood vessels alike serving as portals for the reception of the poison, which is speedily transported thence to the general system. In the uterine structure, however, is manifested the characteristic action of the streptococci. As soon as they invade the vessels of the uterus they produce changes which break down the endothelium and result in the development of a thrombus. After a while, the thrombus in turn breaks down, and the emboli thus formed spread the organisms in various directions. Many of them lodge in the immediately adjacent vessels of the myometrium, while others, gaining access to the systemic circulations, sanguiferous and lymphatic, are conveyed to distant organs and structures, where they become foci of secondary suppuration. In the uterus itself, however, there are speedily established, either primarily or secondarily, similar

foci of suppuration, by which the organ may become converted into what may be described as an aggregation of small abscesses. The individual accumulations of pus may vary from a few drops to a drachm or even more. Occasionally two or more of these centres of suppuration may coalesce, forming a larger abscess cavity. It should be borne in mind that these suppurative changes occur in the myometrium, and that the condition is essentially one of interstitial suppurative metritis. The invasion of the lymph spaces by the streptococcus results very speedily in the development of an acute septic lymphangeitis, involving the lymphatics, first, of the pelvis, and, subsequently, of the remoter parts of the system. The lymphatic glands may, themselves, become foci of suppuration. It should be remembered, however, that the streptococci do not produce suppuration so promptly as do the staphylococci, and that, consequently, in the cases under consideration, pus does not appear in the uterine structures at once. In the earlier stages of the infection there occurs simply a diffuse infiltration of the tissues, which, if incised, will set free a clear yellowish fluid in which are a few pus cells. As the streptococci develop, however, they manifest their characteristic effect of producing a coagulation necrosis, which becomes the focus of suppuration. In the course of a few days, a parturient uterus which is the seat of this infection may vary in length from 15 to 18 centimetres, and in fundal width from 12 to 15 centimetres. The uterine wall at the fundus is about 3 centimetres in thickness. When cut open, the interior of the uterus above the cervical canal is covered with a dark tenacious mucus, which is very offensive. The placental site is distinct, and may contain fragments of firmly attached placenta. The incised myometrium, as in Cartledge's cases (*Transactions of the Southern Surgical and Gynecological Society*), reveal numerous small discrete abscesses varying in size from a millet seed to a large pea. This description of the general macroscopical appearance is based upon examination of the uterus removed by vaginal hysterectomy during the course of the disease, and does not, therefore, depend upon post-mortem changes for any of the peculiarities recorded.

Bumm (*Archiv für Gynäkologie*) has made careful studies of the endometrium, when the seat of puerperal infection, and agrees with Vidal that this structure is the avenue of ingress for the pathogenic micro-organisms that cause the disease. From the endometrium they enter the system in two ways, viz.: first, through venous thrombi, which carries them directly into the circulation, and, secondly, through the lymph channels where they may either lodge in the lymphatic glands themselves or develop foci of suppuration in connective tissue. Kehrer classifies puerperal endometritis into putrid and septic. In putrid endometritis, he asserts that saprophytic micro-organisms cause a change in the decidua, in which septic germs do not develop. This change, he contends, affects only the uppermost layer of the decidua, which is exfoliated as the new mucous membrane forms beneath it.

These changes, he considers, are manifested by fever and other symptoms of intoxication due to decomposition. Kehrer, however, admits that saprophytic infection is exceedingly rare, and that in the majority of cases of endometritis following abortions and labours, bacteriological examination reveals the presence of septic micro-organisms, especially streptococci, and sometimes pyogenic staphylococci, so that, as already contended in this chapter, the cases are in reality examples of mixed infection. In the histological examination of a case of so-called putrid endometritis in which, notwithstanding the presence of streptococci, a predominating influence seemed to be exercised by the saprophytes, the following histologic conditions were observed: the superficial layer of the decidua was filled with micro-organisms, among which were all forms of rods, long threads, and cocci of all sizes. Fungi were found growing in colonies entirely covering the base of the decidua. The tissues were found in a state of necrosis, glassy and cloudy, at a point 0.1 millimetre beyond the area occupied by the fungi. The granules could not be stained. Beyond the zone of infection a zone of cellular infiltration had formed. Numerous small round cells were observed which looked like colourless blood corpuscles and formed a layer 0.3 to 0.5 millimetre thick; they were lying close together. The zone of cellular infiltration occupied a position between the superficial area of infection and the muscularis. The fibres of the myometrium, however, were found occasionally to be separated in places by an accumulation of cells, but this condition did not penetrate deeply into the muscularis. The round-celled infiltration, according to Bumm, must be looked upon as an effort on the part of Nature to set up a granular wall to act as a barrier against the entrance of the germs, and thus to separate the dead from the healthy tissue. The fact, however, that neither Bumm nor Kehrer have succeeded in demonstrating the existence of this so-called putrid endometritis, independently of the existence of streptococci in large, if not in preponderating numbers, indicates that the effort to establish a variety of infection depending upon the existence and the action of the saprophytes is not warranted by the facts. This becomes the more apparent when consideration is given to the histological appearances of what Kehrer and Bumm designate as septic endometritis. The mucous membrane in these cases is necrotic and reveals the remains of the spongy layer, thoroughly covered with streptococci yielding pure cultures. The cocci occur in thin layers, while in other places they appear as large colonies occupying considerable areas. There is a reaction zone, less pronounced but none the less persisting, just as defined as in the putrid variety. The protection, however, thus afforded, seems to be less complete, as there are fewer round cells, and the necrotic zone disappears into the neighbouring tissues without showing any sharply defined boundary. In these situations the streptococci grow and penetrate deeply into and through the striæ of the myometrium. The muscular tissue itself reveals an opacity in the presence of large accumulations

of cocci. Where these accumulations occur, they are surrounded by small collections of round cells; in some places the lymph spaces are filled with cocci, while, at the placental site, the venous spaces are closed and contain neither thrombi nor cocci. A few venous branches near the surface, however, contain blood clots which inclose a few of the cocci. An extension of the infection from the surface into the lymph spaces is demonstrable in numerous sections. Some of the finer lymph spaces show a delicate fungus border on their walls, while others are empty or filled with granular material. When the infection occurs within the lymph channel, it does not seem to provoke reaction in the surrounding structures. In other locations, the lymph spaces are filled with fungi, while the cocci are observed in the surrounding tissues. In still other places, the lymph channels are filled with cocci, whence the fungi spread beyond the necrotic muscular layer, provoking a reactionary accumulation of cells in the adjacent tissues. The inflammation, thus centring about different foci, may result in the liquefaction of the entire infected mass, changing it into an abscess cavity. Bumm raises the important question: How can we explain the fact that the affection sometimes remains local, while in other cases it invades the lymph channels or the veins? His answer is that the bacteria must explain this. They are beyond question the agents which produce this form of disease. The danger exists, not in their number, but in their virulence. In making this statement he simply emphasizes the observations of Vidal and Chantemesse. In the local septic infection, and in the thrombotic forms, the germs are only mildly virulent and are made harmless by the speedy reaction that occurs in the organism. On the other hand, the extremely virulent germs penetrate the walls of the uterus and there is no local reaction. The germs occurring in the lymphatic form he would place midway in virulence between the extremely virulent, or, as he expresses it, the internal, puerperal, erysipelatous form, and the mild, local or thrombotic forms. In view of these facts and of the practical identity in character, if not in degree, of the pathologic changes, and in view of the demonstrated common etiology, all of which is at least inferentially admitted by Bumm, there can hardly be said to exist any substantial reason for discriminating between the different varieties of infection as they are manifested in puerperal fever. On the other hand, the evidence seems to be cumulative that this infection should be recognised as depending for its essential characteristics upon the *Streptococcus pyogenes*, and that occasional modifications due to the presence, in varying proportion, of saprophytes and other micro-organisms, should be recognised as incidental rather than essential variations.

It is important to remember that infection which may invade the lymph channels, may travel through those highways to the peritoneal surface, occasioning thereby a true infection of the peritoneum. It has been stated that in parenchymatous suppuration of the uterus the infection may penetrate directly through the tissues to the peritoneal

surface; but, be this as it may, the fact remains, that streptococcous infection of the interior of the uterus is speedily followed in many cases by involvement of the peritoneum. When infection of the peritoneum takes place, the serous secretion, which is copiously thrown out, becomes a culture medium for the rapid reproduction of the streptococci, which are rapidly absorbed thence by the numerous stomata of the peritoneum. *Puerperal peritonitis* is, therefore, always associated with profound systemic intoxication. Another avenue by which the infection may reach the peritoneum is that of the Fallopian tube, which is frequently invaded by the progressive contamination of contiguous mucous surfaces. As a rule, however, the moment that septic inflammation is established within the Fallopian tube, the distal, or fimbriated, extremity becomes sealed, thus converting the tube into a sort of retention cyst. Leakages may occur, however, particularly when the tubal distention has resulted in rupture.

The *symptoms* of streptococcous infection of the uterus begin with a chill, which may or may not be preceded by fever. The temperature reaction, however, which follows the initial chill is generally severe. The lochia which, up to this time may have been normal in quantity, colour, odour, and consistence, are temporarily checked, become darker in colour, more viscid, and have an offensive odour. The thermic range now becomes characteristically irregular. Another chill, which may be either slight or severe, is followed by a profuse perspiration, generally of a clammy character, succeeded by marked exhaustion. The chills now become irregular, recurring either daily, or sometimes skipping a day; in which case two or three chills may occur in the course of 12 or 24 hours, being then followed by another interval of immunity. The chills are, however, more prone to occur during the evening or the night than in the morning or afternoon. The fever curve may show an evening exacerbation followed by a morning remission, as in certain forms of malarial toxæmia, but, as a rule, the vacillation is of a very lawless kind. As a rule, the first febrile manifestation amounts to three or four degrees; after this, there is a slight remission involving a drop of one or two degrees; then a slight rise and a slight fall. The rise rarely reaches the original elevation and the fall never approximates the normal line. In the course of eight or nine days, however, it will be discovered that the vacillations are a little more pronounced—i. e., the elevations are a little higher and the depressions a little lower than formerly, while the vacillations occur with greater frequency than before. There seems to be a constant tendency for the highest and lowest points to get farther and farther apart. There are, of course, individual exceptions to the rule just given. In the presence of a particularly virulent infection the initial chill may be very profound, the elevation of temperature may be high and may so continue during the course of the disease, showing but very slight remissions. The cardiac centres are early influenced by the infection, the pulse rising to 120, or higher, and being generally

soft and compressible. The respiration is rapid, the tongue speedily becomes coated, generally with a white fur, though ordinarily moist. There is not, as a rule, marked disturbance of digestion, particularly to the degree which occurs in septicæmia. As the disease advances, however, the patient becomes emaciated and anxious, and delirium may supervene, although in some cases the intelligence remains intact until a short time before death.

The *diagnosis* of streptococcous infection of the uterus is made, first, by a careful estimation of the preceding symptoms; and, subsequently, by detection of the streptococcus. A curette or a curette forceps may be passed into the uterus, when some of the *débris* of degeneration can be removed. Microscopic and bacterial examination of the scrapings will reveal the presence of the *Streptococcus pyogenes* but in association, perhaps, with other micro-organisms. It will, however, be found in such preponderating numbers that the essential character of the infection can not be mistaken. A drop of blood taken from the tip of the finger or from the ear will reveal the presence of the streptococcus and blood plaques in the presence of a pronounced leucocytosis. The red corpuscles are diminished in number, many of them presenting a shrunken appearance.

The *treatment of streptococcous infection* of the uterus must have a threefold object, namely, (1) to arrest the infection, if possible, at its point of entrance; (2) to eliminate the poison from the system after the invasion has passed beyond the point of entrance; and, (3) to support the patient during the course of the pyæmic sequelæ of the infection.

A moment's consideration of the pathology of this infection renders it unnecessary to emphasize the importance of prompt intervention to arrest the infection. The first signs of temperature disturbance, whether an initial chill followed by fever, or an initial pyrexia without a chill, associated with a change in the quantity, colour, and odour, of the lochia, should be the signal for a careful exploration of the uterus. If, from examination, the fact is determined that the symptoms are of intrauterine origin, there should be no hesitancy in practising thorough curettement under the most rigorous antiseptic precautions. With reference to the use of the curette under these circumstances much unnecessary dispute has arisen. Those who question the expediency of its employment apparently fail to take into account, either the character of the infection, or the primary pathologic changes which it induces. The formation of thrombi in the orifices of the veins in the placental site is, of itself, sufficient to materially diminish the outflow of fluid from that source; while the inflammatory exudation arrests the free escape of serous elements from the intervenous areas. At this juncture, Nature is found in the act of rallying her resources to repel the invader, and there may be said to be a temporary check in the course of the infection. This is precisely the time when treatment, to be of the most value, should be

applied with the most thoroughness. The patient should be anæsthetized; placed upon the table in the recumbent position; a Jones's, or other perineal retractor should be used; the vagina should be thoroughly irrigated; and the uterus should be washed out by means of a recurrent catheter. A sharp curette with a blunt, protecting edge, like that of Gau's, should be inserted, and the uterine wall should be thoroughly scraped. If free bleeding is induced, so much the better, as the hemorrhagic current has the mechanical value of washing away remaining elements of infection. Great care should be taken to avoid penetration of the soft uterine wall. After the interior of the uterus has been thoroughly curetted, the cavity should be washed out by a 1-to-2,000 solution of the mercuric bichloride, a recurrent uterine irrigator being employed for the purpose. The uterine cavity should then be packed with a long ribbon of iodoform gauze saturated with sterilized glycerine. Glycerine, by virtue of its hygroscopic qualities, favours an outward current of transudation, and thus, if it does not promote elimination of any remaining infection, it, at least, offers some barrier to the further invasion of the tissues. The patient should be placed in the recumbent posture at the expiration of twenty-four hours, when the uterine packing should be removed and carefully reapplied after the uterine cavity has been again irrigated by the sublimate solution. There is no occasion to repeat the curettement provided that it has been well done, and the patient will not, therefore, require an anæsthetic. The dressing should be changed at similar intervals during three or four days, when, if the temperature range becomes normal, the treatment may be discontinued. Some excellent practitioners employ constant irrigation of the uterine cavity, instead of packing with iodoform or other antiseptic agents, and very good results have been reported from this course of treatment. For its accomplishment a reflux uterine irrigator, such as that devised by Gaither, should be used. This is an excellent instrument, and secures the reflux current by effecting the dilatation of the cervix to any desired degree. It is more valuable than the ordinary tubular instruments, which are prone to become choked by clots or other *débris*.

The object of curettage is only half realized when the infected *débris* has been scraped away; it is equally imperative to asepticize, so far as possible, the remaining endometrium. To accomplish this, the uterus may be packed as indicated in the preceding paragraph. Some excellent practitioners employ constant drainage with the best results. Ill (*Transactions of the American Association of Obstetricians and Gynecologists*) packs the uterus with iodoform gauze, which is kept saturated with an antiseptic medicament applied through a hollow curved tube (Fig. 155). This ingenious arrangement secures both an influx and an efflux of fluid, and is deserving of consideration.

If, however, in spite of these precautions the temperature continues to vacillate and to show a characteristic pyæmic range, and particularly if the pulse goes to 120, with a tendency to increase

in frequency and to diminish in force and volume, the evidence is to be construed as meaning that the infection has invaded the lymph channels, and that the myometrium has become the seat of diffuse infection, if not of multiple suppurations. It is manifest that, under these circumstances, the disease has passed beyond the control of such a conservative measure as curettement. The condition indicated by this persistence of symptoms is one which, if left alone, is calculated constantly and progressively to re-enforce the systemic infection, and

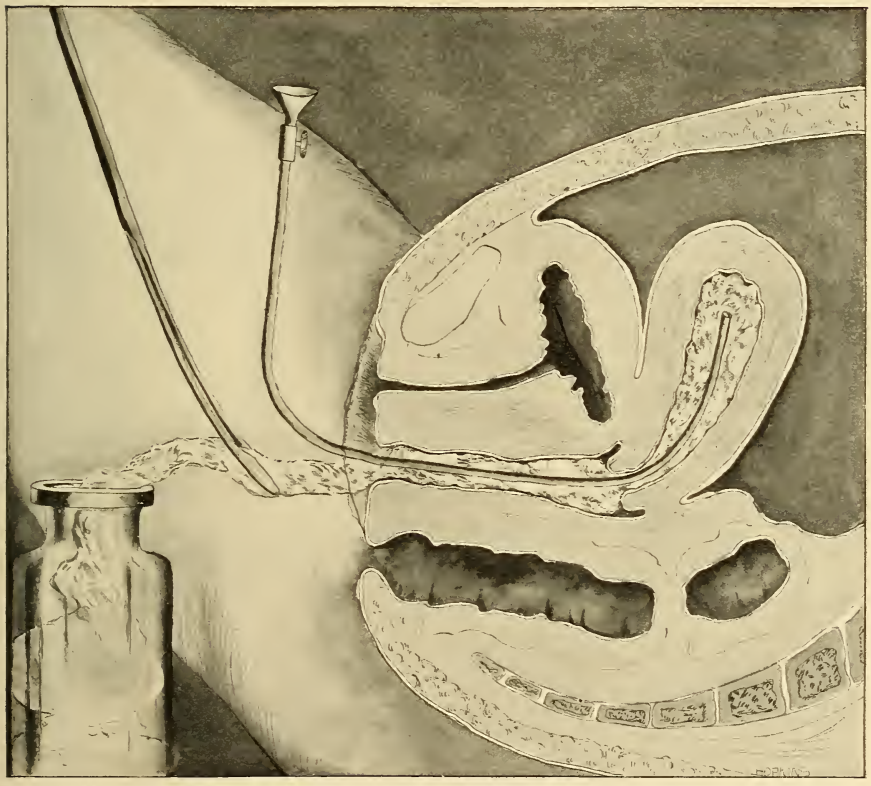

Fig. 155.—"Ill packs the uterus with iodoform gauze, which is kept saturated with an antiseptic medicament applied through a hollow curved tube."—Reed (page 382).

thereby to keep alive a pyæmic state which must result in death. An intelligent comprehension of the symptoms and of the underlying pathologic conditions can not result in any other conviction than that the line of treatment must be *complete removal of the uterus*. Successful cases of this character have been reported by Vineberg, Cartledge, and others. The operation may be done either through the vagina or by abdominal section. The latter route is generally preferable, for the reason that the uterus may be too large to be easily delivered through the vagina, while in its septic state, its morcella-

tion would be a dangerous expedient. Extraordinary antiseptic precautions should be taken in making an abdominal section under these circumstances. The patient should be prepared by a thorough vaginal and intrauterine irrigation, and the uterus should be packed with dry iodoform gauze. It may not be amiss to close the os externum by passing a single suture through the anterior and posterior lips of the cervix. By this means the field of operation will be fairly well protected from contamination. These preliminary steps should be taken by the assistant, or, if by the operator himself, he should employ rubber gloves for the purpose. As soon as the intravaginal manipulations are concluded the rubber gloves employed at that time should be taken off, and should be replaced by another pair carefully sterilized. In this way, alone, can the operator feel sure of giving reasonable protection to his patient. The operation should be that of panhysterectomy, involving, as the name implies, the removal of the entire uterus with its appendages. The technique of the operation does not differ in any particular from that described in the chapter on panhysterectomy. It is well, as a matter of routine, to practice hypodermoclysis both before and after the operation, three or four pints of water being administered in this way.

Supporting treatment should be adopted from the start, care being taken to preserve the digestive functions, which, happily, are not, as a rule, seriously compromised in these cases. Stress has been laid upon alcohol as an article of diet, and the testimony seems to support the claims for its consideration. Whisky may be given in the form of milk punch every few hours. Wines are not, as a rule, so well borne, and beer is more prone to disturb the gastric and other functions. Mild acidulous drinks are usually demanded, to control the generally persistent thirst. The bowels should be kept relaxed, but active purgation should be avoided. The old theory of treating these cases with cathartics to favour the elimination of the poison, is, in the light of the now well-understood pathology, a fallacious doctrine.

The suggestion has been made that in view of the probable upward extension of the infection in puerperal fever, and of the consequent involvement of the Fallopian tubes, a sound should be passed through the uterine cavity and the orifice of the tube for the purpose of drainage; some, indeed, have gone so far as to suggest the expediency of irrigating the Fallopian tubes. (See Infections of the Fallopian Tubes.) A method of this kind is unsurgical in the extreme, for the reasons, first, that no surgeon, however deft he may be, can be sure of the distention of the tube; and, next, that he can not distinguish the orifice of the tube within the uterine cavity in the postparturient condition. The most that he will be likely to accomplish by the procedure is to establish a fresh infection atrium within the uterus.

Tuberculosis of the Uterus.—A description of tuberculosis of the uterus must be divided into two parts, since it is a well-established fact,

according to Whitacre, that tuberculosis of the body of the uterus and tuberculosis of the cervix are quite independent of each other. A lesion beginning in one portion rarely passes beyond the anatomic dividing line (the internal os), and the pathologic changes which the tubercle bacillus causes are markedly different in the two regions.

Tuberculosis of the Cervix Uteri.—Tuberculosis of the cervix is a condition which was declared by Rokitansky and Lebert not to exist, and Spaeth in 1885 collected only six cases. Since 1886, however, when Hegar demonstrated the clinical importance of genital tuberculosis, and since the introduction of routine methods of bacterial and microscopic examination of cervical secretions and curettings, the number of cases has multiplied rapidly, and tuberculosis of the cervix is looked upon at the present day as a condition that must enter into the diagnosis of every lesion of the cervix.

The disease is usually secondary to tuberculosis of the Fallopian tubes, peritoneum, or vagina, yet it may be the sole seat of tuberculosis in the genital tract of phthisical women, or, as in the cases of Friedlander and Péan, it may represent the only seat of tuberculosis in the entire body. The relative infrequency of cervical tuberculosis has been explained by the resisting power of the squamous epithelium on the portio vaginalis, and by a natural antibacterial action of the cervical canal, as has been demonstrated experimentally by Menge. Predisposing causes of infection are undoubtedly to be found in irritating discharges, lacerations, and erosions. It is difficult to explain the immunity of the uterus to a simultaneous infection when the lesion is clearly secondary to a tuberculosis of the Fallopian tubes or peritoneum. The monthly exfoliation of the corporeal endometrium probably plays a definite rôle (Sippel, Vassmer, Schöttlander). The infection of the cervix may take place by an extension from either the higher or the lower parts of the genital tract, by way of the blood stream, or by direct inoculation from without.

Morbid Anatomy.—In describing the lesions of tuberculosis of the cervix Whitacre recognises:

1. A miliary form.
2. A diffuse tuberculous infiltration with ulceration.
3. A papillary form.

Schütt describes a fourth form in which the lesion consists of an apparently simple bacillary catarrh, which is limited to the epithelium and forms a caseous layer over its surface. Daurios has suggested a fistulous form, but the occurrence of fistulæ must be considered accidental.

The miliary form may be looked upon as the first stage of the diffuse tuberculous form, and may be described as a catarrhal inflammation of the cervical mucosa with the presence beneath the epithelial surface, of miliary tubercles too small to be seen by the naked eye. The folds of the arbor vitæ become enlarged and produce pronounced villosities and secondary villosities with deep fissures between the folds. The

epithelium over the surface remains intact, and small masses of round cells containing giant cells, and a few tubercle bacilli, are found in the stroma which is at the same time the seat of a small round-celled infiltration. The glands are not at first involved. Below the mucous membrane, miliary tubercles of larger size are found, and even when we have to do with a tuberculous eruption which is slight, superficial, of recent date, and has caused no destruction of tissue, we must expect to find the muscular layers infiltrated by miliary tubercles which are formed along the course of the blood vessels. The condition may continue as a miliary tuberculosis, the most frequent form of cervical involvement, or the miliary tubercles may increase in size and number, become caseous, and run together to form the lesions of the second or diffuse form, where the mucous membrane is converted in part, or in its entirety, into an ulcerating caseous mass. When this occurs, the glandular elements show every degree of destruction, the tissues show infiltration and thickening, and the cervical canal becomes a worm-eaten cavity containing caseous material (Matthews). The interior of such a cavity is lined by tuberculous granulations which bleed easily and exude a heavy discharge, and the muscular tissues are infiltrated by discrete miliary tubercles. There is a marked tendency to fibrous infiltration, as was first pointed out by Williams.

The *papillary form* of cervical tuberculosis, as reported by Fränkel, Cornil-Péan, Franqué, and Vitrac, possesses a special interest from a clinical point of view because of its naked-eye resemblance to carcinoma (Fig. 156). It is characterized by a papillary growth of the arbor vitæ which pushes back the pavement epithelium of the portio vaginalis and attains a considerable tumour formation. These tumours show slight tendency to break down and present the typical microscopic picture of tuberculosis. Their naked-eye appearance is not typically tuberculous.

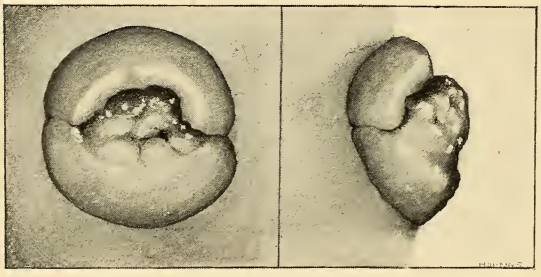

Fig. 156.—"The papillary form of cervical tuberculosis."—Whitacre.

Symptoms and Diagnosis.—In determining the symptoms of tuberculosis of the cervix it is difficult to separate them from the symptoms of the primary disease, which is often of much greater importance than the lesion in the cervix. A primary cervical lesion gives no pain, and there is usually present a muco-purulent leucorrhœa which may be occasionally tinged with blood. A physical examination of the cervix will reveal one of the conditions previously described.

The *diagnosis* of tuberculosis from simple cervical endometritis on

the one hand and carcinoma on the other forms an important feature in the description of tuberculosis of the cervix.

The condition will be distinguished from simple cervical catarrh by the amount of destruction taking place in the tuberculous ulceration, by the presence of caseous material in the discharge, and by the demonstration of the tubercle bacillus in the cervical secretions. Some confusion with chancroid has arisen in cases reported by Spaeth and Zweifel. In the ulcerative and papillary form of the disease, the possibility of confusion with the much more common condition of carcinoma must be constantly borne in mind. Many cases of tuberculous cervicitis have been operated on for carcinoma and their true nature only revealed on microscopic examination (Cornil, Fränkel, Kaufmann, Goglio, Vitrac, Emanuel); and it is probable that many such mistakes pass unrecognised when the material is not submitted to microscopic examination. The following table has been arranged by Whitacre to aid the diagnosis between the two conditions:

	Tuberculosis.	Epithelioma.
Size	Small.	No regularity.
Aspect	*Papillary* form: A muriform mass with small vegetations in the vicinity. *Ulcerative* form: Surface covered by caseous material and mucus. Border a seed bed of granulations.	Usually fungous. The cavity form lacks granulations in the edges. Never solely interstitial.
Colour	*Papillary:* Rose-red, deeper colour than surrounding. *Ulcerative:* Bottom yellow or red.	Grayish.
Touch	*Papillary:* Surface knobbed, smooth, polished, elastic, no induration, limits not clear. *Ulcerative:* Depression without diffuse induration. Border granular.	Surface roughened, consistence very hard. If large and fungous, the base is very hard.
Spontaneous pain	Little or none	Characteristic.
Sensitiveness	Present	Absent.
Bleeding	May be slight in both papillary and ulcerative form.	Frequent and abundant.
Discharge	*Papillary:* Mucous. *Ulcerative:* Often purulent.	Fœtid and abundant.
Progress	*Papillary:* Extremely slow. *Ulcerative:* Slow, yet may produce extensive ulceration and fistulæ.	Progressive and accompanied by constitutional symptoms.
Pathologic histology	Both show typical miliary tubercles and tubercle tissue.	Typical epithelioma with pearls and columns of cells.
Bacteria	Tubercle bacilli found in smear preparations, or by inoculating guinea pig.	None.

The *treatment* of tuberculous disease of the cervix should be radical when the disease is primary and whenever it will prolong the life or contribute to the comfort of the patient, but there are naturally many cases associated with advanced tuberculosis of the lungs, intestines,

or tubes, in which no operative measures would be justifiable. Any operation undertaken for the cure of the condition must be extensive, since Cornil and others have shown that, even in recently developed and apparently superficial tuberculosis, there is already an extension of miliary tubercles along the blood vessels into the deepest muscle layers. If the uterus can be demonstrated to be free a high amputation of the cervix should be done, yet many authors insist upon hysterectomy as the rational treatment because of the almost uniform involvement of the tubes, the difficulty of getting beyond the tuberculous process, and the fact that there is no certain method of determining the presence of a tuberculous endosalpingitis. (For technique see Panhysterectomy and Vaginal Hysterectomy.) Aron and Tillaud warn against forcible, mechanical handling of the cervix, since we may thereby set up a general tuberculosis. Palliative measures will consist in the thorough curetting and cauterizing of ulcers, the excision of fistulæ, the treatment by iodoform, and cleansing douches.

Corporeal Tuberculosis of the Uterus (Tuberculous Endometritis).—Tuberculosis of the body of the uterus, or tuberculous endometritis, must be described, as has already been stated, as a lesion distinct from tuberculous cervicitis, and its frequency, compared with that of the latter condition, will make it a much more important lesion. Tuberculosis of the uterus occurs in two thirds of all cases of general tuberculosis; it occurs in connection with tuberculous disease of other genital organs, or the process may be primary in the endometrium. From the point of frequency, the corporeal endometrium stands second among the female genital organs. This type, like all other forms of genital tuberculosis, has been studied more especially since Hegar called attention to its clinical importance, yet the frequency of the uterine disease has only been fully appreciated in the last few years since routine histological and bacteriological examinations of all curettings have been made. Its real frequency is certainly well shown by a series of six cases which were observed by Vassmer in the very short period of ten months.

The uterus certainly may be infected by the tubercle bacillus either from above or from below, and its frequent association with tubal disease would indicate that a descending infection is the more common. Coitus certainly must be considered to be a source of infection when we remember the frequency of tuberculous disease of the male genito-urinary tract, and particularly since the demonstration by Jani of tubercle bacilli in the semen and in the apparently healthy prostate and testicles of men suffering from phthisis. Numerous cases are reported where women suffering from genital tuberculosis have lived with tuberculous men. Jani has injected the apparently healthy testicle of tuberculous men into the peritoneal cavity of guinea pigs and has produced a typical tuberculous peritonitis. It has been asserted that a tuberculous process arising from coitus is primarily a tubal tuberculosis, and that the uterus is secondarily infected. Instruments

or the examining finger may carry infection, or the transfer may be by direct self-infection from a tuberculosis of the vulva, vagina, or from tuberculous stools. The relative immunity of the vulva, vagina, and cervix, has been explained by their protecting flat epithelium, and in the uterine cavity we find again a decided protection in the monthly exfoliation of the mucous membrane. The puerperal state certainly predisposes to infection, as is shown by the authentic cases of Frorieps, Rokitansky, Heimbs, Brues, Geil, Schüll, and by the demonstration of tubercle bacilli by Hünermann in a septic thrombus after abortion. Schmorl, Rockel, Thorn, and others, have reported cases of pregnancy that began and went to full term in spite of a caseous endometritis.

The age of the patient seems to make little difference, yet Kaufmann holds that the female organs show a predisposition to tuberculosis with the decline of their activity.

Morbid Anatomy.—Pathologically, tuberculosis of the uterus is divided by most authors into—

1. A miliary form without ulceration.
2. A chronic diffuse or caseous endometritis.
3. A chronic fibroid type.

The second is the clinical type with which we are familiar; the first is the very earliest stage of the chronic diffuse form or a part of a general eruption of tubercles and gives no symptoms; while the third has been very rarely recognised.

The study of these lesions will be much simplified by considering them to be different stages of the same condition, and by stating that conditions of number and virulence of the bacteria, mixed infection, and the activity of the reparative process, will determine the miliary, caseous, pyometric, or fibroid form.

The *miliary form* begins by a deposit of minute tubercles in the interglandular substance of the mucous membrane of the fundus of the uterus near the entrance of the Fallopian tubes (Kelly, Cullen, Williams, Walther, Vassmer). The epithelial surface remains intact, as does also the glandular element, and the presence of a few tubercles made up of epithelial cells alone, or of single giant cells containing tubercle bacilli, may be the only evidence of tuberculosis in the entire mucosa. Later, the epithelioid nodules are surrounded by small round cells, and still later giant cells appear in their centre and only remnants of the glands remain (Fig. 157). In more advanced cases, the miliary tubercles are more numerous, and the glandular tissue is so much affected that Cornil and Franqué have characterized it as a chronic tuberculous endometritis with the principal participation of the glands, which become enlarged and show indistinct markings. Coincident with the glandular hypertrophy there is a strong infiltration of the interglandular tissue (Abel). Polyp formation, however, which is so frequent in other types of endometritis, and which forms a distinct class in tuberculous cervicitis, does not occur, and nodules larger than a pea are never seen. Madlener and Zahn have reported cases in which large polypi

were found to contain miliary tubercles and tubercle bacilli, but they are considered to be a secondary infection of a pre-existing polyp.

The miliary tubercles finally run together, caseate, and break down to form irregular undermined ulcers, which, by their confluence, convert the endometrium into a caseous mass involving, first, the superficial layers, then, the entire thickness of the mucous membrane. Below this is a zone of typical tuberculous tissue consisting of epithelioid cells, tubercles, giant cells, and a varying amount of gland remnants. It is important to remember that the caseous mass simply replaces the mucosa (Pozzi). The muscle tissue shows distinct miliary and submiliary tubercles which are formed along the course of the infiltrated blood vessels (Hofbauer). The muscle tissue is usually distinctly hypertrophied and finally becomes extensively infiltrated and destroyed. A mixed infection by the pyogenic cocci, when associated with mechanical obstruction of the internal os, will lead to *pyometra*—a very common condition.

Fig. 157.—"Giant cells (*b*) appear . . . and only remnants of the glands (*a*) remain."—Whitacre (page 389).

The *chronic fibroid type* of tuberculous endometritis was first described by Williams as a miliary tuberculosis characterized by an excessive development of fibrous tissue within and around the miliary tubercles. Thus far, it has been recognised on the autopsy table alone.

The *symptoms* of the disease are not characteristic and are practically those of an ordinary endometritis with thickening of the uterine wall. Pain, temperature, and a general tuberculous appearance are absent. There may be a noncharacteristic, mucopurulent, even caseous, discharge, but Vassmer has found no discharge in a series of six cases. Amenorrhœa was present in the majority of reported cases, excessive bleeding very seldom; but menstrual disturbance is probably not important. Suspicious points in the history will be the chronicity, the presence of a general tuberculosis, and tuberculosis in the husband.

Diagnosis.—As has just been stated, the symptoms of tuberculous endometritis are not sufficiently characteristic to distinguish it from

simple endometritis or carcinoma, and experience has shown that the diagnosis can only be made by detecting the tubercle bacillus in the histologic structure of tubercle tissue in scrapings from such a uterus. The tubercle bacillus has been found with varying frequency both in the secretions from the uterus and in uterine curettings (Walther, Veit, Péraire). In the beginning stages of the disease, their scarcity renders a diagnosis by this means extremely difficult, but in the more advanced forms the bacilli are numerous. When not found by microscopic examination in curettings, their presence may be demonstrated by injecting the curettings into the peritoneal cavity of the guinea pig. A typical peritoneal tuberculosis will develop in from twelve days to four weeks if the bacilli are present, even in small numbers.

The histological diagnosis is made difficult by the fact that the tubercles are not always typical, that a simple infiltration of the stroma looks much like tubercle tissue, and that giant cells are sometimes found in an interstitial endometritis. The presence of the epithelioid cells of tuberculosis in the stroma of the mucous membrane, together with the occasional distortion of the glands, may lead to a confusion with carcinoma.

Treatment.—The question of the appropriate operative treatment for tuberculous endometritis is as yet *sub judice.* Certain operators would insist upon hysterectomy as soon as the diagnosis is made (Schauta, Pozzi, Fehling); while others would recommend simple curetting and subsequent cauterization with pure carbolic, and treatment by iodoform. Sippel, Walther, Meyer and Halbertsma report cases of complete cure after curetting, the latter after five years. Sippel has shown the healing influence of continued menstruation on disease processes in the mucosa—a fact which must not be disregarded.

It must be remembered, however, that tuberculosis of the uterus is generally secondary to tubal tuberculosis, and in the presence of advanced disease demanding removal of these organs there could be slight reason for preserving the uterus. The association of a unilateral tubal tuberculosis will call for a laparotomy for the removal of the tube, and a thorough curettement of the uterus. It must be remembered in removing tuberculous appendages, that a tuberculous endometritis probably already exists, and that the uterus should be curetted if left behind. Kelly has found a tuberculous involvement in such cases when it was entirely unsuspected. It is well to remember that these cases should not be considered malignant, and that conservative measures are indicated in selected cases.

Syphilis of the uterus was formerly supposed to be of relatively frequent occurrence. This was due to the fact that, before the days of Emmet, the granular surface of a cervical ectropion was frequently mistaken for a true ulcer—often syphilitic in character. Since laceration of the cervix has become a recognised condition, it is discovered that what was formerly looked upon as ulceration, is, as already stated, nothing more or less than the everted mucous membrane,

studded with hypertrophied follicles. Syphilis may occur as either a *primary* or a *secondary* affection of the uterus.

Chancre of the cervix was recognised in 1838 by Ricord, who found it in 12 out of 199 cases, or, practically in 6 per cent of women presenting themselves at his clinic with primary syphilitic sores. Schwartz found it in 93 out of 686 collated cases. Chancre of the cervix is of about the same frequency of occurrence as primary chancre of the vagina. This statement is based upon tables compiled by Glück (*Wiener medicinische Presse*, 1881), by which it appears that primary infection of the vagina occurs in from 0.87 per cent to + 6 per cent of all cases of primary syphilis in women. Chancre of the cervix is generally single, although it may be multiple. It may coexist with chancre in some other part of the genitalia. Fournier (*Annales de gynécologie*, 1876) reported a case in which three chancres of the cervix coexisted with one involving the fourchette. Whitehead (*Abortion and Sterility*) reported a case of syphilitic ulcer of the cervix, associated with constitutional symptoms, while a similar case was recorded as long ago as 1859 (*British Medical Journal*) by Parker. Herman (*Obstetrical Transactions*, London, 1885) recorded a case of large chancre of the cervix, associated with distinct secondary symptoms. Mackenzie (*British Medical Journal*, 1854) called attention to the fact that important pathologic changes in the uterus occur as the secondary results of syphilis. Parker confirmed this view.

The *symptoms* of primary infection of the uterus consist of an ichorous discharge, associated with more or less general pelvic discomfort. This circumstance generally leads to an examination when an ulcer not self-inoculable and presenting the characteristic physical features of a chancre, is revealed. These ulcers may vary in size from a minute disk to the size of a shilling. In Herman's case the ulcer was of the latter size and presented the appearance of a grayish-yellow slough, surrounded by an inflamed areola. The edges were sharp, discrete, and indurated. If of long standing, it may be associated with syphilides of the vaginal mucosa and the pudendal integument.

In chancre of the cervix the inguinal lymphatics are not involved, unless the condition coexists with a primary sore of the external genitalia. Intrapelvic lymphangeitis and lymphadenitis are, however, frequent concomitants. The lymphatic vessels can be felt like tender and tense cords above either fornix of the vagina; while the enlarged glands may be felt as distinct nodules in the superimposed cellular structure. Infection of the intrapelvic lymphatics may result in suppuration of the glands—a condition which may, with propriety, be designated as an internal bubo.

Secondary syphilis of the uterus is generally associated with a purulent discharge and with enlargement and tenderness of the portio vaginalis. Patches of redness, sometimes of a very dark colour, are frequently noticed on the cervix. In the centre of certain of these

reddened areas, ulcerative tendencies are occasionally manifested. Careful examination will generally reveal slight deposits of cicatricial tissue on the cervix. Ulcers varying in size and appearance are occasionally found.

Endometritis is a common accompaniment of these changes. It is to this condition that the tendency of syphilitic women to miscarry, is attributed.

Careful bimanual exploration will generally reveal more or less hypertrophy of the entire uterus. Parker considers these symptoms indicative of syphilis, because, according to his observation, they are found in about 60 per cent of the cases of confirmed lues; while they are not found with anything like equal frequency in women in whom a syphilitic history can not be otherwise established.

The *diagnosis* of chancre of the uterus can generally be made by careful study of the physical conditions presented. The promptness with which the lesion yields to antisyphilitic treatment, will dispel any remaining doubts as to the character of the trouble. Secondary syphilis of the uterus, however, may readily be confused with hyperplasia due to other infectious causes.

A careful study must, therefore, be made, not only of the previous clinical history, but of the bacteriological features of the case.

Treatment.—The treatment of these cases may be summarized as antisyphilitic. Chancre of the cervix should be cauterized, with either nitric acid, or the pure nitrate of silver. After the slough separates, the ulcer should be treated with iodoform, the vagina being kept packed with iodoform gauze. The parts should be carefully irrigated, between dressings, with a 1-to-2,000 solution of bichloride of mercury. Constitutional treatment should consist of the administration of mercury, either in combination or alternating with the iodides. The more profound organic changes of the uterus may require attention. Forcible dilatation of the cervix and vigorous curettage of the endometrium are the only means by which hypertrophy of the latter structure may be overcome.

Echinococcous infection of the uterus, while not of common occurrence, probably exists with greater frequency than is indicated by the records. The demonstration of hooklets in many so-called "hydatid moles" of the uterus is an indication of parasitic origin of, at least, an important number of these cases. It would seem as if a more careful investigation of these intrauterine products would tend to eliminate pregnancy as an essential element in their production, and to restrict their etiology within the category of infections. That echinococci may, however, attack the decidual structures of a recent pregnancy, is beyond doubt. These organisms may also invade the muscularis of the uterus. When the parenchyma is the primary *locus* of infection, the resulting parent cyst may develop, as does a myoma, either beneath the mucous membrane, or beneath the peritoneum. One of the earliest cases on record—i. e., MacNeven's (*New York*

Journal of Medicine, 1849)—was an example of submucous development, while a more recent case by Altormyan (*Lancet*, April 4, 1891) is a distinct example of subperitoneal development of the cyst. The same may be said of the case reported by Freünd and Chadwick (*American Journal of Obstetrics*, 1874–'75).

The *symptoms* of echinococcous infection of the uterus are not essentially pathognomonic. There is tumefaction in the uterine region; a sense of weight, that may run through several months or years; cessation or irregularity of menstruation; increasing pressure on the bladder and bowels; while there usually occurs a progressive decline of general health. The tumefaction, which is ordinarily median at its commencement, may develop either to one side or the other, according as the tumour grows either to the right or to the left. The tumour, itself, in a case of parenchymatous infection, is generally described as smooth and elastic. When it presents in the uterine cavity or at the cervical margin, it is generally fluctuating at the presenting point, although the palpation wave is transmitted but indistinctly to remoter parts of the growth. In the uterine cavity, the cyst may present many features in common with the amniotic sac for which it has been mistaken. In cases of echinococcous infection of the uterine cavity, the symptoms may be essentially those of pregnancy. The uterus becomes enlarged and softened, the cervix presenting a bluish aspect. The womb enlarges, progressively and symmetrically, the breasts enlarge and may contain milk, while there are not infrequent reflex disturbances of the stomach. It is the occurrence of these symptoms which has generally caused infections of the uterine cavity by the echinococcus, to be looked upon as pregnancy, and the resulting cysts to be designated as degenerated ova. In practically all these cases, however, the usual amenorrhœa of pregnancy is absent, while the patient complains of more or less constant dribbling of blood from the uterus. While this is true, the fact must be recognised that infection of the uterine cavity by the echinococcus may coexist with pregnancy, as was true in MacNeven's case, in which a large echinococcus cyst was expelled, intact, during a true labour and immediately preceding the rupture of the amniotic sac. The exact diagnosis can not be made without the demonstration of the hooklets. Echinococcous infection of the uterus may occur at any age. Szancer (*Zeitschrift für Geburtshülfe und Gynäkologie*, 1879) reports a case occurring in a girl of twelve, while Hislop reports one aged seventeen, and it has been found in patients of more advanced years.

Invasion of the uterus seems to be effected through any abrasion in the mucous surface, although, in a number of cases, the infection of the uterus has been secondary to the invasion of remoter organs, notably the liver. Microscopically, the cysts consist of structureless stratified membranes, containing scoleces and separate echinococcic hooklets. The cysts, themselves, multiply by endogenous proliferation, the resulting mass consisting of a large mother cyst containing

numerous daughter cysts, varying in size from a millet seed to a pea, or even larger. Each cyst contains clear, limpid fluid, containing no sediment, but yielding traces of albumin. When evacuated by incision, the mother cyst does not collapse readily, showing the existence, not only of structural development, but of extensive peripheral infiltration.

Evidence seems to point to the lymphatics as the chief avenue for the migration of these infectious elements, particularly when considered with reference to their secondary manifestation. These parasites have, however, the ability to penetrate the normal matrix; even after evacuation of the parent cyst, progressive invasion of the tissues may occur, until the peritoneum, the bladder, or even the intestine, is penetrated.

Treatment.—This consists in the evacuation of the cyst whenever accessible. The cyst cavity should be opened freely, its walls should be curetted vigorously, after which it should be irrigated, first with 25-per-cent solution of hydrogen peroxide, and subsequently packed with iodoform gauze. Drainage should be maintained until the cavity is thoroughly collapsed. If, however, the disease shows a tendency to progressive invasion of neighbouring structures, hysterectomy should be performed. When the infection is restricted to the uterine cavity, the expulsion of the cystic product generally results in the immediate recovery of the patient.

CHAPTER XXVIII

NEOPLASMS OF THE UTERUS

Neoplasms of the uterus in general; varieties—Benign neoplasms—Fibromyomata: Causes, pathology, histology, secondary degenerations, diagnosis—Complicating pregnancy—Treatment: Medicinal and electrical; surgical, terms employed—Indications—Myomectomy—Supravaginal hysterectomy; extra-peritoneal treatment of the pedicle—Panhysterectomy; Reed's operation; vaginal hysterectomy—Vaginal myomotomy—Extirpation of polypi.

Neoplasms of the Uterus in General.—There is, perhaps, no organ of the body, in either the male or the female, which is so often the seat of tumour formation as the uterus. The intrinsic causes of neoplastic diseases of the womb are usually as obscure as of those of any part of the body. Embryonic inclusions, nutritive disturbances, irritation, and heredity, play a certain rôle as predisposing causes, yet their relation to tumour formation is by no means always demonstrable. Neoplasms of the uterus may be considered in relation to the different parts of the organ from which they arise. They may be divided according to their main clinical features into benign and malignant, or, according to their histology, into connective tissue and epithelial new growth. The connective-tissue tumours occurring in the uterus are the *fibromyoma*, the *sarcoma*, the *endothelioma*, and some mixed tumours of minor importance. The epithelial neoplasms comprise the *adenoma malignum*, the *carcinoma*, and the *syncytioma malignum*.

Benign Neoplasms of the Uterus

The tumours variously designated as **fibroma, fibromyoma, fibroid** or **myoma** of the uterus, are the most common neoplasms that develop in that organ. They are derived from the muscular coat and are composed of involuntary muscle cells and ordinary fibrous connective tissue, mixed in varying proportions.

Their *causes* are various. The time of life when fibromyomata usually occur is that of sexual activity, but there have been reported a number of cases of this kind in children and in women after the climacterium. A good deal has been written upon the subject of the influence of prolonged virginity and abstinence from sexual intercourse, married life, abnormal sexual irritation, sexual excesses, masturbation, and so forth, upon the development of fibromyoma. Hered-

ity has likewise been considered as a factor in the production of these neoplasms. Race has been cited as a predisposing cause. It is well known that many American writers hold that myomata are much more common in the negro than in the Caucasian races. The statistics, the views and the theories of various experienced authors, are, however, so contradictory in many points, that we can not draw any definite general conclusions, and must for the time being leave open many questions as to the etiology of true fibromyoma.

There is one class of fibromyomata, recently fully described in a classical monograph by von Recklinghausen, the *adenomyomata,* which in their origin clearly stand in a causal nexus with certain embryonic inclusions in the uterus.

Veit, in an article on the etiology and symptomatology of fibromyoma, comes to the following conclusions: "So far as the common myomata (excluding the adenomyoma) are concerned, I hold that their origin from an embryonic inclusion ('anlage') has not been proved. It appears, however, that heredity plays a rôle therein, and one is also able to understand that irritation, acting chronically upon the uterus, may give rise to the formation of myomata; the *modus operandi* of the latter, however, is not yet clearly proved."

Pathology of Fibromyoma Uteri.—Fibromyomata may arise from the muscularis of the body as well as from that of the cervix. They vary a good deal in size and shape, and their particular position has a good deal of influence in this respect. They may be single, but more frequently they are multiple. One not infrequently finds in uteri removed for some cause, or obtained from the post-mortem table, very small myomata which have not given rise to any symptoms. On the other hand these tumours may attain an enormous size. Stockard saw in a coloured woman a myoma weighing 135 pounds, and Hunter reports the finding post mortem of a myoma weighing 140 pounds, while the rest of the body weighed 95 pounds. According to their seat and mode of origin, myomata are divided into *submucous, interstitial,* and *subserous.*

Submucous myomata have their seat under the mucous membrane. They may be attached by a broad base to the muscularis or they may, and this is more commonly the case, become pedunculated and project polyplike into the uterine cavity. These myomata are generally rich in blood vessels and muscle fibres and comparatively soft. They usually grow rapidly but rarely attain a very large size If by their growth they are forced down into the cervical canal they sometimes assume an hourglass or dumb-bell shape. They have a marked tendency to undergo degenerative changes and to slough. The descent of these submucous myomata is often due less to their own neoplastic growth than to œdematous swelling in consequence of circulatory disturbances and to contractions of the uterus. These muscular contractions of the womb may sometimes bring about the spontaneous separation and delivery of a submucous myoma.

Interstitial fibromyomata develop in the middle stratum of the muscularis uteri. They are, as a rule, well encapsulated, and can therefore be easily enucleated. Only rarely is this variety intimately blended and connected by interlacing bundles of muscle fibres with the surrounding parts. If such interstitial tumours grow very large they may so stretch the parts of the uterus below that these form a kind of peduncle for the tumour. Such peduncles may in rare cases undergo torsion.

The *subserous fibromyomata* are developed from the most superficial layers of the muscularis and project from the peritoneal surface. They are connected with the uterus by a more or less constricted short peduncle (Fig. 158). Smaller subserous myomata may also have a broad base, but the larger ones are generally pedunculated. The peritoneum firmly overlies the tumour and is intimately blended with it so that it can not easily be peeled off. These tumours, in conquence of their usual mode of attachment to the uterus, are generally more or less movable. The peduncle may undergo torsion or kinking. Subserous myomata are very liable to form adhesions with the neighbouring sexual organs, with the intestines, and with other structures. Myomata of this variety, springing from the lateral margins of the uterus, often grow into the broad ligament, separate its layers, and give rise to what is known as *intraligamentous fibromyomata.*

Fig. 158.—"They are connected with the uterus by a more or less constricted short peduncle."—Herzog.

Histology of Fibromyomata.—Histologically, the fibromyomata of the uterus consist of the same tissues as compose the muscularis of the uterus, namely, involuntary, smooth muscle fibres, and fibrous connective tissue. These two kinds of tissues are present in varying proportions. Some tumours may contain only a small amount of fibrous connective tissue, while in others it may so predominate that an almost pure fibroma exists. The muscle cells are arranged in bundles which cross each other and interlace with a great deal of variety and irregularity. Yellow elastic fibres are likewise found, also those particular cells known as "mast cells" and "plasma-mast cells."

A particular variety of myoma is the *adenomyoma*. These tumours are ordinarily of moderate size, and are generally found near the serous surface in the posterior uterine wall and near the tubal angles. They are not encapsulated but shade off diffusely into the surrounding tissues and contain, besides the usual tissue elements of fibromyoma, epithelial structures. These latter are of a peculiar glandular type. There are generally seen a number of smaller ducts which communicate, like the teeth of a comb, with a larger duct. These epithelial structures are derivatives of remnants of the Wolffian duct and of the "urniere" of the Wolffian body, which have been displaced in development, and which, as embryonic inclusions, give rise to the appearance of these peculiar new growths. The latter, from a histological standpoint, must be looked upon as a mixture of connective tissue and epithelial neoplasms.

Fig. 159.—"A shell composed of lime salts."—Herzog (page 400).

Fibromyomata often bring about changes in the whole uterus. The muscular coat, particularly if the myoma is so situated that it causes uterine contractions, is liable to undergo some hypertrophy characterized by an increase in size of the individual muscle cells. The uterine mucous membrane shows either a glandular or an interstitial hypertrophy. Herzog has also frequently observed an extensive œdematous infiltration of the mucosa, with or without capillary interstitial hemorrhages. Tubes and ovaries are likewise affected when large myomata are present in the uterus. Endosalpingitis, salpingitis interstitialis, and oöphoritis interstitialis with condensation of the ovarian stroma and round-cell infiltration, have been described.

Secondary Degenerations of Myomata.—The secondary degenerations occurring in myomata are quite numerous. *Atrophy* sometimes occurs

after pregnancy and after the menopause has been established, and under other conditions. *Calcareous* degeneration is common, and small particles of carbonates and phosphates of lime are very frequently found in myomata. Or there may be formed a solid stone or a shell composed of lime salts. Herzog examined a case of the latter kind. The specimen was obtained by an operation performed by Dr. M. L. Harris, on a woman seventy years old. It formed an elliptical mass about 14 centimetres long, consisting of a shell several millimetres thick, composed of lime salts (Fig. 159). Reed removed from an aged patient a large interstitial fibroid of lateral development which had distended the broad ligament carrying the ovary and Fallopian tube of that side nearly to the umbilicus (Fig. 160). On opening the tumour a shell of calcareous matter and several foci of calcareous

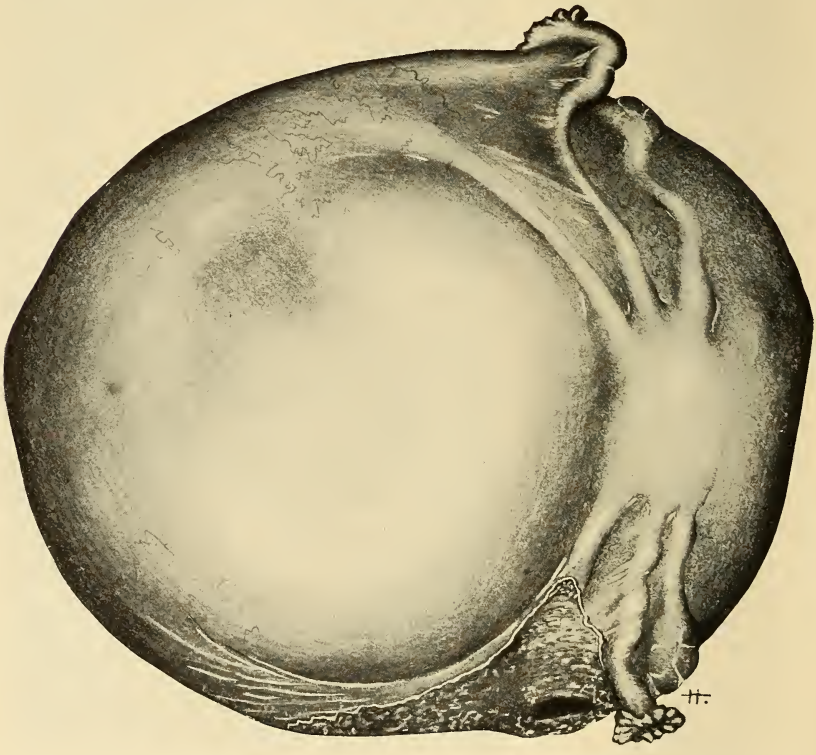

Fig. 160 (Reed).—"Reed removed from an aged patient a large interstitial fibroid of lateral development which had distended the broad ligament, carrying the ovary and Fallopian tube of that side nearly to the umbilicus."—Herzog.

degeneration were found (Fig. 161). *Fatty degeneration* is also frequently seen; it often leads to the formation of cystic spaces in the tumour. *Myxomatous degeneration, inflammation, necrosis,* and *sloughing,* are observed in fibromyomata. *Amyloid degeneration* has been once

described by Stratz. Of *malignant changes* in a primarily benign myoma, *the sarcomatous degeneration* is the one most frequently met with. Von Recklinghausen has seen several cases of *carcinoma* developing in

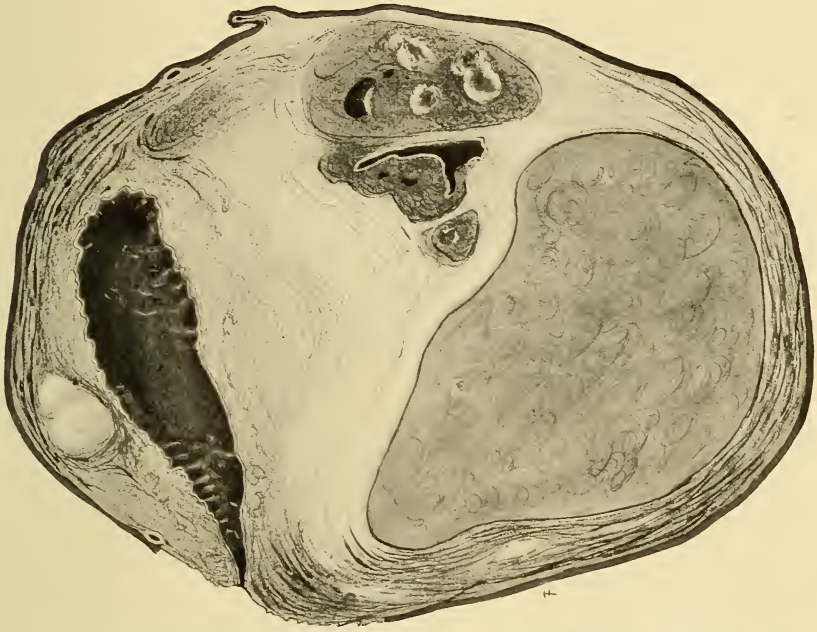

Fig. 161 (Reed).—"On opening the tumour a shell of calcareous matter and several foci of calcareous degeneration were found."—Herzog (page 400).

adenomyomata. The other mixed tumours, myochondroma and myo-osteoma, have been described, as well as rhabdomyoma of a sarcomatous type.

Diagnosis.—These tumours are common in women of all races and of all ages, though more frequent in negroes and in women between the ages of thirty and forty years. Although found prior to puberty in rare instances, these growths are essentially incident to the menstrual period of life. Unmarried and sterile women are especially prone to this disease.

Hemorrhage, while not invariably present, is a common and conspicuous symptom of uterine fibromata. Profuse and prolonged menstruation is a marked and characteristic symptom. It is not uncommon to observe the most profound anæmia in consequence, the patient's skin assuming a waxy, yellowish hue, with anæmic heart murmur and profound general exhaustion.

Pain is a conspicuous symptom in the majority of cases, and is the result either of pressure or of associated inflammatory disease of the Fallopian tubes and ovaries. The pain of pressure is determined more by the site of the tumour than its size. Thus, when growing

from the lower uterine segment and packing the pelvic cavity, the pressure on bowel, bladder, and nerve trunks, will be more severe than when the tumour is situated higher and rises freely above the brim of the pelvis. The ovaries and tubes are often found in a mass of inflammatory adhesions, and hydrosalpinx and pyosalpinx are not uncommon accompaniments of these tumours. Such complications may render small fibroid tumours painful in the extreme. Irritability of the bladder, and obstipation resulting from pressure of the growth, are common symptoms.

The *diagnosis* of uterine fibromata is determined by recognising these symptoms in conjunction with careful physical examination of the pelvic organs. The bimanual touch will disclose the presence of a tumour, usually irregular in outline, and attached to the uterus. If the tumour is large, its firm consistence and nodular character may be detected by palpation through the abdominal parietes. Interstitial fibromata of symmetrical development may be mistaken for pregnancy (Fig. 162), an error more easily made from the fact that pregnancy

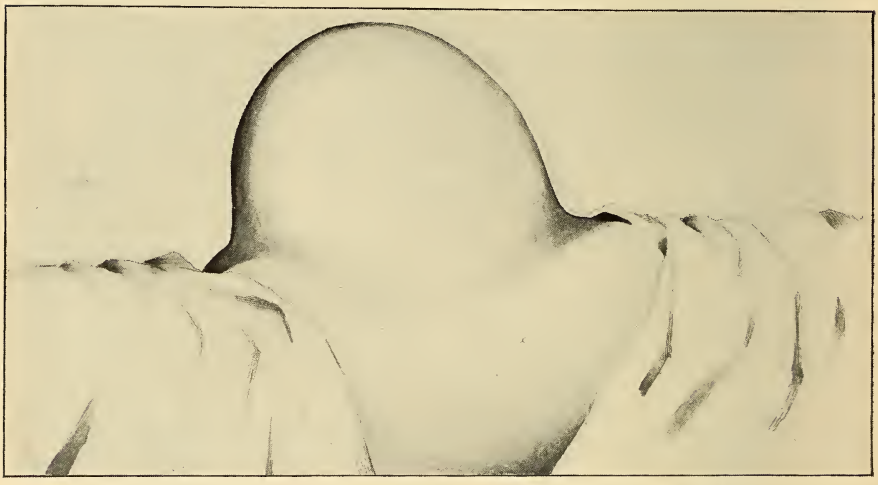

Fig. 162.—"Interstitial fibromata of symmetrical development may be mistaken for pregnancy."—McMurtry.

not infrequently coexists with these tumours. The soft fibroma, especially if œdematous, is distinguished with difficulty from an ovarian cystoma; and when cystic degeneration has taken place in the fibroma, diagnosis is impossible. Diagnosis is also practically impossible between polycystic ovarian cystoma with general adhesions, and symmetrical uterine fibroma. The clinical importance of these difficulties, however, is offset by the practical fact that both classes of tumours should receive the same treatment, viz.: removal by abdominal section. The vaginal portion of the cervix is rarely involved by fibroid changes in the uterus (Fig. 163). A small fibroid in the posterior uter-

ine wall may be mistaken for retroflexion of the uterus; and such a tumour springing from the supravaginal cervix may be interpreted by the touch as inflammatory exudate. Such errors can be avoided only by careful study of the symptoms and history of individual cases, with painstaking bimanual examination after the bladder and bowel have been thoroughly emptied. Instrumentation *per vaginam* and digital exploration *per rectum* will rarely afford any special advantage over these established means of diagnosis, and unless done with skill and without force, will inflict pain and prove harmful.

Fig. 163.—"The vaginal portion of the cervix is rarely involved by fibroid changes in the uterus."—McMurtry (page 402).

Pregnancy as a complication of uterine myomata occurs with sufficient frequency to deserve special consideration. It is a matter of great practical importance to determine whether the life of the mother is endangered and operation consequently imperative; or, whether pregnancy and parturition may be safely completed without surgical intervention. While it is exceptional for a woman with large uterine myoma to become pregnant, numerous cases are recorded where the uterus has proved equal to the demand and carried the child to safe delivery near to or quite at full term. Under the stimulus of pregnancy, with its increased blood supply, fibroid tumours grow rapidly; and small tumours hitherto unnoticed may become conspicuous. It is also true that, after delivery, fibromata participate in the retrograde changes in the uterus and shrivel to insignificant proportions.

In certain exceptional cases, where the tumour arises from the lower segment of the uterus and fills the lower pelvis, thereby obstructing the passage of the child, the vital question of operative intervention must be met and determined. A case of obstructive myoma in which a successful operation was done by McMurtry is illustrated in Fig. 164 (*New York Medical Journal*). Similar cases have been reported by Price, Hanks, Reed, Vander Veer, Ross, and others. This question should receive the most conservative consideration, for, in many instances, the uterus will bear its additional burden, and if the tumour is above the pelvic brim, or can be pushed above when labour comes on, safe delivery of a living child may be accomplished. The operative procedure in hystero-myomectomy, wherein pregnancy is a complication, does not differ in any essential particular from the operation when performed in uncomplicated cases.

Treatment: Medicinal and Electrical.—Various drugs have been recommended as either curative or beneficial in the treatment of fibroid tumours of the uterus. Such medicinal agents as ergot, gallic acid,

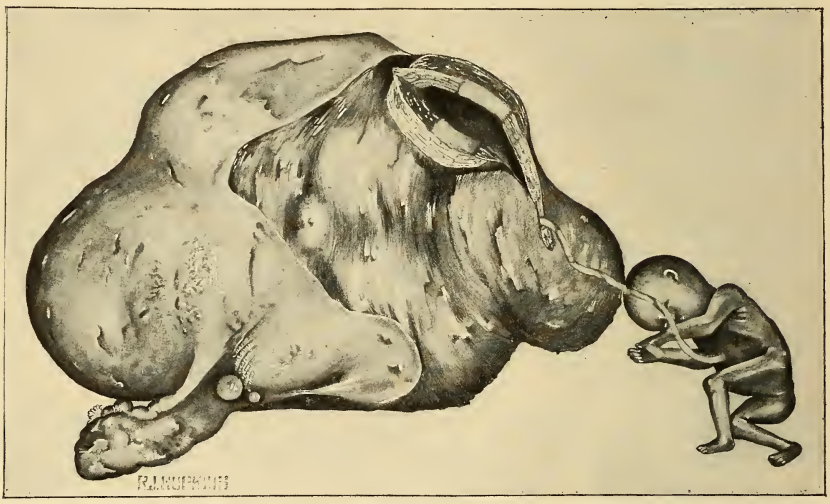

Fig 164.—"A case of obstructive myoma in which a successful operation was done."—McMurtry (page 403).

hydrastis, and some preparations of iron, have enjoyed favour in this capacity, being especially in repute for controlling hemorrhage, arresting growth, and diminishing the size of the neoplasm. It can be clinically demonstrated that such agents do not yield the benefits claimed for them, while by impairing digestion and producing constipation they are harmful in their general influence upon the system. Fibromata of the uterus are so constantly influenced by circulatory changes in the pelvic viscera, such as menstruation and impaired resistance, that errors of judgment may readily be made by the overconfident observer.

The results formerly claimed for deep injections of ergot, and more recently for electrical applications, have proved misleading and have resulted in the discarding of these remedies. Such treatment is not only inefficient, but positively harmful, in consequence of the constant localized peritonitis produced thereby. The perfected operative treatment (Fig. 165) of modern surgery has taken the place of all treatment both with drugs and electricity. (See chapter on General Therapeutics.) When the tumour is of small size and unaccompanied by hemorrhage or other serious symptoms, no treatment whatever will be required. The requirements of individual cases must guide the practitioner in the determination of these important considerations.

In approaching the **surgical treatment** it is well to have a distinct understanding of some of the terms employed. The terms *myomectomy* and *hystero-myomectomy* both indicate operative procedures for the re-

moval of fibroid tumours of the uterus. The former term is applied to the operation in which the tumour or tumours are removed and the uterus preserved; the latter indicates the removal of the uterus in part or in whole along with the tumour. *Hysterectomy* properly denotes removal of the uterus without regard to the presence of neoplastic formations, but is habitually used as synonymous with the term hystero-myomectomy in treating of fibroid tumours. Hysterectomy may be partial or complete. The term *supravaginal hysterectomy* is applied to amputation of the uterus at the internal os, leaving a cer-

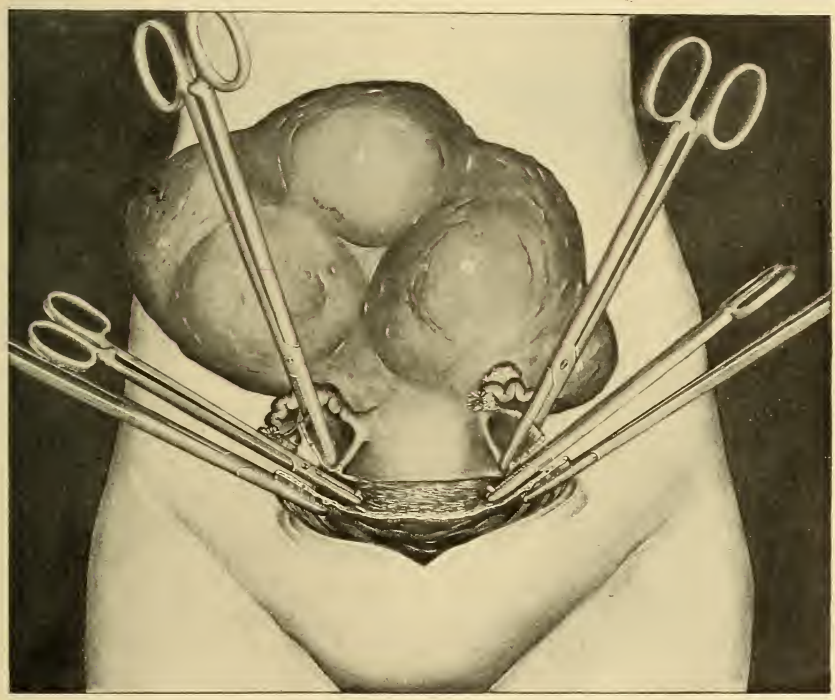

Fig. 165.—"The perfected operative treatment of modern surgery has taken the place of all treatment both with drugs and electricity."—McMurtry (page 404).

vical pedicle (Fig. 166); *complete hysterectomy*, involving the removal of the entire uterus including the cervix, is often termed *panhysterectomy*.

Indications for Operation.—The operations for the removal of fibroid tumours have reached a stage of perfection that elicits admiration and commands confidence. Since we have learned to control hemorrhage in these operations, the indications for the operation have advanced beyond the limitations that obtained a few years since. Those who have practised the removal of the ovaries for the reduction in size of a myomatous tumour, or for the purpose of staying the growth of such a tumour, know well that the convalescence in such cases

is fraught with serious complications that give the operator a great amount of anxiety. As a consequence of the rapidity with which a circulatory change takes place in these tumours after ablation of the ovaries, suppuration occasionally sets in, the tumour begins to break

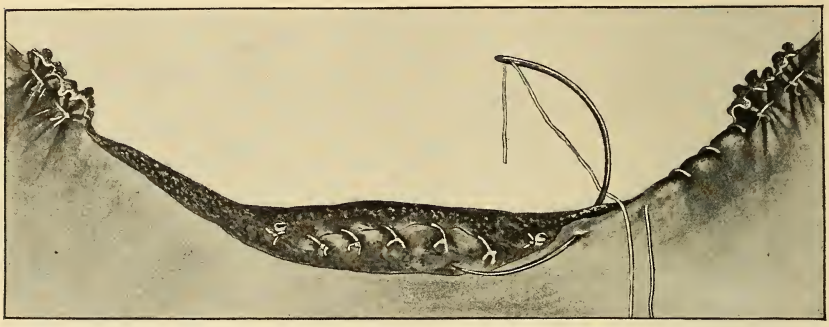

Fig. 166.—"Amputation of the uterus at the internal os, leaving a cervical pedicle."—McMurtry (page 405).

down, and the patient becomes desperately ill. An experienced operator, therefore, will be more anxious to remove fibroid tumours entirely than to remove the ovaries alone. It is, therefore, becoming a serious question as to which operation in skilled hands, performed according to modern methods, is the more serious of the two. That is, whether the operation of abdominal hysterectomy or myomectomy, when performed for the removal of moderate-sized tumours, is more serious than the removal of the ovaries from their position alongside such tumours. Indications for the removal of such tumours are, rapid growth, grave hemorrhages from the uterus, ascites, compression on important organs, suppuration or degeneration of the tumour, and pregnancy under certain circumstances. When the tumour grows rapidly it may undergo malignant degeneration, or become œdematous. Small pedunculated tumours are not likely to be reduced in size as a consequence of the removal of the ovaries, and when these tumours give rise to pressure symptoms their removal is necessitated.

General Considerations.—The removal of small pedunculated growths is a simple matter. The uterus, ovaries, and tubes, are left intact and the patient has her sexual organs practically uninterfered with. There is a class of cases in which we may remove the tumour by a process of enucleation and leave the uterus intact. We have certain tumours deep down in the pelvis or in the broad ligaments that require enucleation. In some of these cases it is found impossible to control the hemorrhage without removing the entire uterus and we must always be prepared to go on and complete the more extensive operation. In all these operations it is important that we should be able to control the hemorrhage with ease as the operation proceeds. The elastic ligature is perhaps the most valuable aid we

have. This should only be used temporarily, and be abandoned after the hemorrhage has been checked by other means. A few years since the serre-nœud of Koeberlé was used, but this is now very largely discarded. The elastic ligature is passed around the cervix and broad ligaments, and is held in position by means of an artery forceps placed upon it after it has been pulled taut. It does not require very much pressure to control the hemorrhage.

Myomectomy.—For removing the pedunculated fibromata the elastic ligature is placed in position, a needle armed with a double silk ligature is then passed through the pedicle, and the pedicle is tied in half sections. If the pedicle is very large and thick it is seized and compressed by clamp forceps while the tumour is cut off, and care is taken to leave a collar of peritoneum and capsule large enough to permit approximation across the face of the stump. The clamp is then removed and the furrow is pierced with a needle carrying a silk suture that is tied in several sections. The edges of the stump above are then approximated by interrupted sutures. The provisional elastic ligature is next removed, and if there is much oozing about the sutures, a few deeper ones must be placed. When large vessels can be seen during the section of the pedicle they are tied separately. The pedicle must not be returned to the abdomen until after all oozing has ceased. If the oozing continues, sufficient time must be given to permit of its arrest by the adoption of appropriate methods; and if it does not then cease something further must be done. It occasionally happens that the uterus, itself, will require removal before the hemorrhage can be controlled. Too much time and blood must not be lost before the operator determines this fact.

Indications.—When a tumour is single, or when there are but two or three nodules, the enucleation of interstitial myomata may be carried out. We must have our patients or their friends understand, however, that if it is impossible to control the hemorrhage the entire organ must be removed. Very large single myomata of the interstitial variety may be removed by myomectomy (Fig. 167).

Some operators have recommended the removal of both ovaries if other fibrous nodules are present and beyond our reach, but it seems only reasonable to suppose that, under such circumstances, it would be better to remove the uterus in the ordinary way by the method of supravaginal amputation. Unless the operation is combined with castration there is always a danger of the development of a second tumour that may be overlooked at the time of the primary operation. To avoid this danger it is necessary to remove both ovaries. As a consequence, this operation would seem to have but a limited field in cases in which it is not desirable to perform supravaginal amputation; in other words, it becomes an operation of expediency.

Many a young married woman may have a fibroid tumour that requires removal. She is willing to have the tumour removed, but she is not willing to submit to the more radical operation of removal

of uterus, ovaries and tubes. A subsequent pregnancy may, it is true, endanger her life owing to the weakness produced in the uterine wall by the enucleation of a myoma, but if she is willing to take her chances it seems but fair that we should perform the operation for her in preference to that of supravaginal hysterectomy.

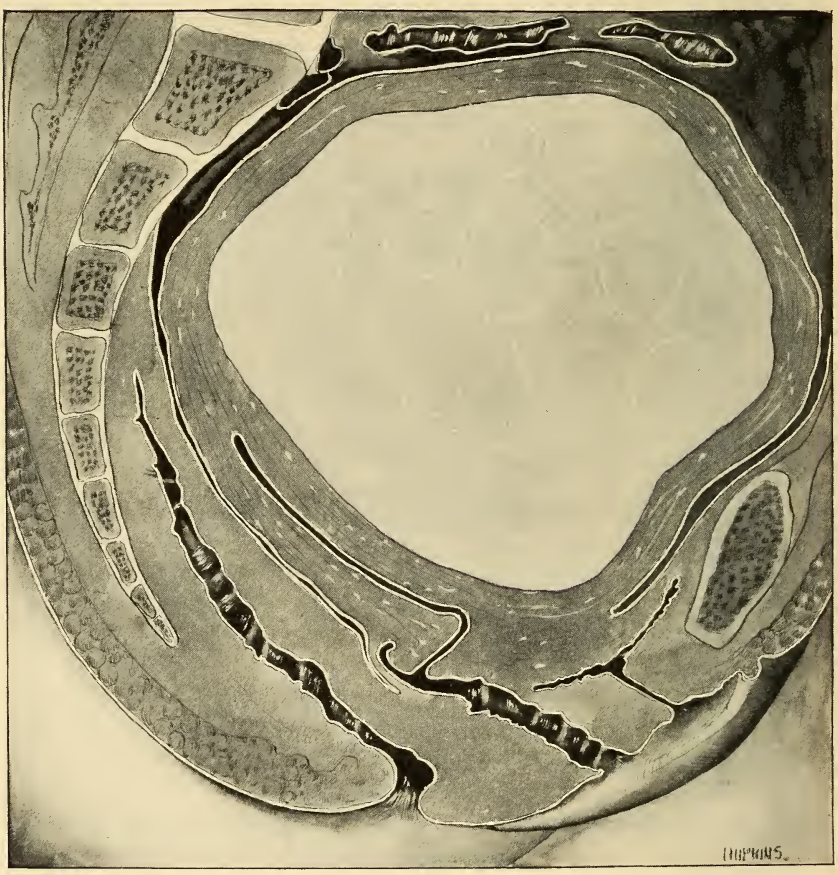

Fig. 167 (Reed).—"Very large single myomata of the interstitial variety may be removed by myomectomy."—Ross (page 407).

Operation.—It is a well-known fact that these myomata bleed from the capsule and do not bleed from the central core, or tumour proper. To control the hemorrhage, therefore, it is necessary to compress the capsule. The elastic ligature when applicable should be placed *in situ* before the primary incision is made into the tumour capsule. These incisions should be made in such a way as to wound the small arterioles and not the large trunks. Incisions in the median line are less liable to bleed than those placed to either side. The incision must go through the capsule to the tumour mass (Fig. 168), and must be

sufficient to permit the enucleation of the tumour. Enucleation should be done by a process of tearing and not of cutting; the vessels will, as a consequence, bleed less. A scoop, similar to that used for the removal of gallstones, or stones from the urinary bladder, may be used as an enucleator. Special instruments have been constructed for this purpose, but are rarely needed. The finger and the handle of the scalpel answer admirably as enucleators. Connective tissue will be found dipping down here and there between the meshes of the tumour and separating its outer wall from the inner surface of the capsule. It is in this connective tissue that the enucleation must be carried out.

After the tumour has been removed, it is wise temporarily to loosen the elastic ligature placed around the cervix, for the purpose of tying vessels that may be seen to bleed specially. In this way

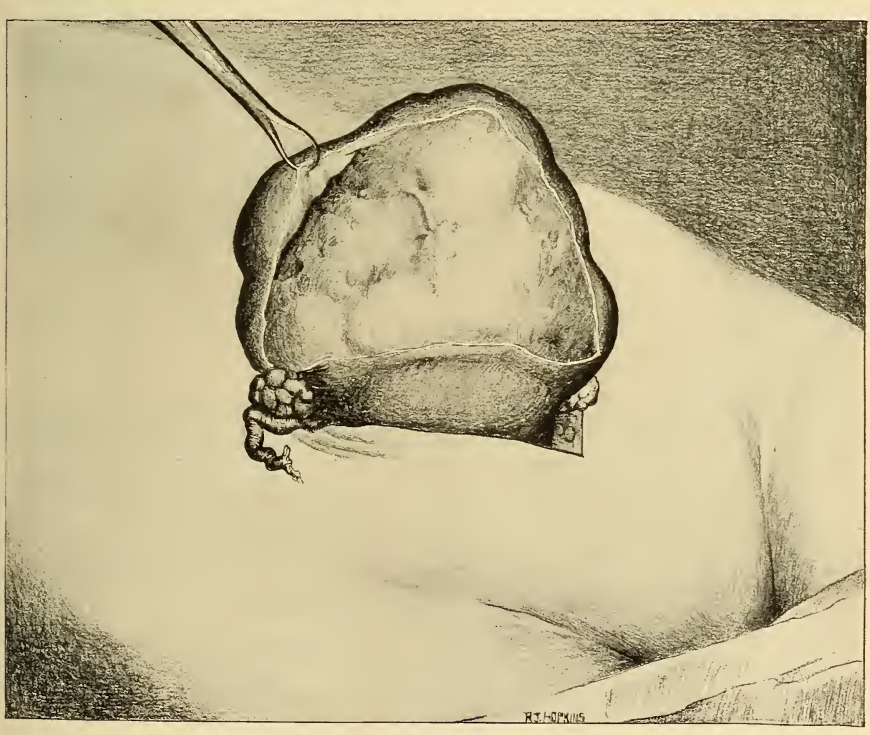

Fig. 168 (Reed).—"The incision must go through the capsule to the tumour mass."—Ross (page 408).

all the large vessels may be tied with catgut ligatures. The elastic ligature can be again tightened and the tissues stitched firmly by means of layers of continuous catgut sutures. Finally, the capsule wall is brought firmly together by a row of interrupted sutures or by a continuous suture of formalinized catgut (Fig. 169). The elastic

ligature is finally dispensed with, and the parts are watched until all bleeding has ceased. It should be a fixed rule not to return the uterus to the abdominal cavity unless bleeding has ceased. One of the great dangers accompanying the operation is hemorrhage into the abdominal cavity after the return to it of the uterus, and after the relaxation of the blood vessels has taken place owing to the cessation of the tension. The uterine canal may be laid bare. When this is the case it is advisable to place a small strip of gauze down through the cervix and pack the cavity left after the removal of the tumour

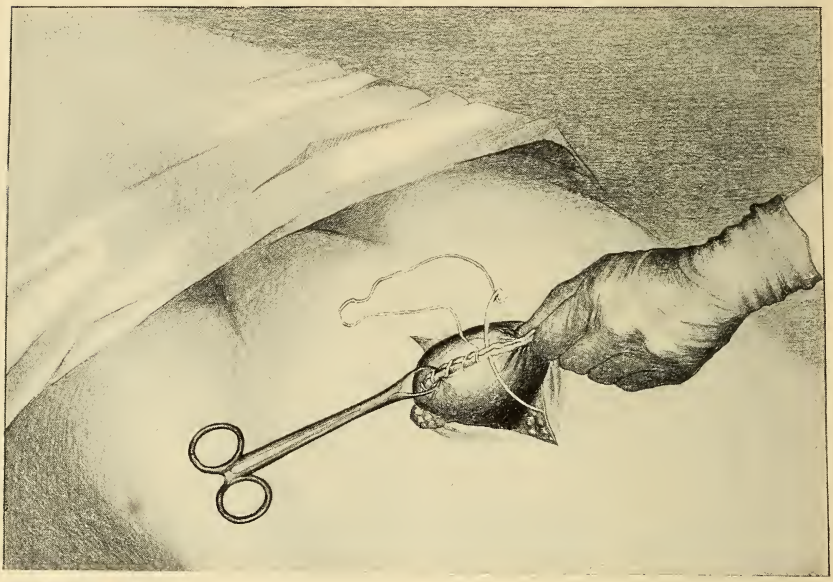

Fig. 169 (Reed).—"Finally the capsule wall is brought firmly together by . . . a continuous suture of formalinized catgut."—Ross (page 409).

(Fig. 170); or drainage may be effected by means of Reed's self-retaining tube passed from the tumour nest out through the cervix and vagina (Fig. 171).

Supravaginal Hysterectomy.—The difficulties to be encountered during the operation depend upon the location of the tumour and the extent of the adhesions. The important fact to be remembered is that the blood supply is obtained through the uterine and ovarian arteries. These arteries can readily be located by means of the thumb and forefinger with gentle pressure. The pulsations can be readily felt. When the blood vessels have been located it is easy to dissect down to them, provided we do not cut, but dissect with the handle of the scalpel, into the cellular tissues of the broad ligament, taking care to avoid the large veins found in these cases. The vessels can be tied either *en masse* or separately as they are found. Just as we place a tourniquet upon the femoral artery before ampu-

tating the thigh, so should we place our ligatures upon the two uterine and two ovarian arteries before attempting to amputate the uterus. If hemorrhage then occurs we may rest assured that we have failed

Fig. 170 (Reed).—"The uterine canal may be laid bare; . . . place a small strip of gauze down through the cervix, and pack the cavity left after the removal of the tumour."—Ross (page 410).

in properly securing the vessels. Blood will flow from the upper or tumour side of the cut, but the proximal side will be almost dry if the vessels have been properly tied. If the uterine cavity is opened,

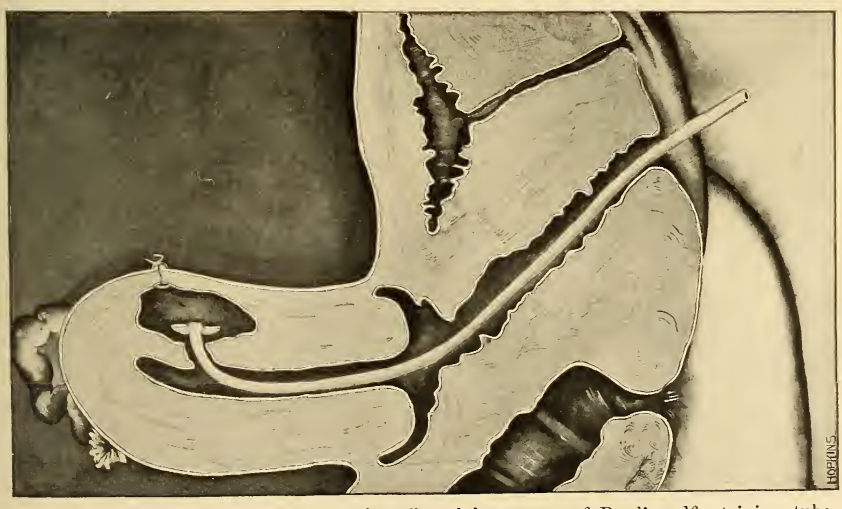

Fig. 171 (Reed).—"Or drainage may be effected by means of Reed's self-retaining tube passed from the tumour nest out through the cervix and vagina."—Ross (page 410).

it is wise to disinfect it with a little pure carbolic acid before stitching up the stump. Some operators pass down a small wick of gauze through the cervix into the vagina to admit of drainage. The great advance that has been made in this surgical procedure is due to the fact that we depend entirely upon ligation of the large blood trunks supplying the tumour for the control of hemorrhage, and that we have done away with the temporary or permanent clamp. Many operators scarcely ever use these aids to hemostasis. In performing this operation, great care should be taken to prevent loss of blood, to economize time, and to avoid subsequent hemorrhage. Loss of blood during the operation greatly increases the rapidity of the patient's pulse; loss of time increases the shock; and loss of blood after the operation will often prove fatal. It is never well to sacrifice thoroughness for speed, but there is a happy medium to be obtained. There is no operation in the whole field of surgery that requires more deliberation.

It is scarcely necessary to describe the operation as performed a few years since by means of the permanent Koeberlé serre-nœud. We rarely see the large ovarian tumours that were common twenty or thirty years ago, because such tumours are now removed when small. So it is with the myomata; they are removed much earlier owing to the diminished risks of operation.

Technique of Supravaginal Hysterectomy.—The usual precautions are taken in preparing the patient. A purgative is given the day before, an enema on the morning of the operation, the skin over the abdomen is thoroughly disinfected, and the armamentarium of instruments required laid out in a convenient place, after having undergone thorough sterilization. The patient must be well wrapped up on the operating table to prevent chilling of the body surface.

The *instruments* required are: scalpel; large and small compression forceps; long-bladed clamp forceps; pedicle needle for transfixion; retractors; uterine sound; female bladder sound; heavy silk; catgut in various sizes; curved needles, various sizes; needles for closing abdominal wound; scissors; rubber tubing for elastic ligature; serre-nœud with hysterectomy pin; glass drainage tube.

The abdomen is now opened by a free incision. If adhesions are encountered great care must be taken in dealing with these, as the tumour surface will bleed at the points from which adhesions are removed. It is much wiser, in dealing with these adhesions, to ligate them in two places and cut them away, leaving a ligated portion still adherent to the tumour. If intestine is so intimately adherent to the tumour as to prevent this procedure, it must be separated with as light a touch as possible. Hot cloths placed over the spots from which adherent intestine has been removed will control the hemorrhage while it is left *in situ*. The tumour is now raised out of the abdomen. Sponges are packed down above it to retain the intestines, and, if the incision has been a long one, it is wise to draw its edges together

above the tumour by means of one or two silkworm-gut sutures. In this way the intestines are kept in the abdomen and out of the way.

We must now outline the bladder limits. This is done by means of a sound passed into the bladder by an assistant. This sound is pushed well upward until the upper confines of this organ are accurately determined. Small pressure forceps are then placed a little above this line to act as guides to the position of the bladder. The peritoneum is now incised over the front of the tumour, care being taken not to go deeper than the peritoneum, because any incision of the tumour capsule will cause hemorrhage. By means of the finger and the handle of the knife, the peritoneum, with the bladder, can then be easily entirely stripped down from the front of the tumour. The connective tissue lying immediately beneath it permits of this loosening process. There is thus no danger of wounding the bladder by the puncture of the pedicle needle.

The ovarian artery on one side must now be felt for and secured, either by a ligature *en masse*, or by a single ligature. If the single ligature is used the veins must also be tied by means of another ligature. These veins are always very much enlarged. A forceps is now placed on the tumour side of the mesentery of the tube to control the regurgitant hemorrhage; and the mesentery of the tube, together with the broad ligament at this point, is cut across. Should any bleeding point be found, it is easy to control this hemorrhage by the application of another forceps. The connective tissue close to the tumour and inside of the veins of the pampiniform plexus can now be seen and pushed into with the finger. If this process is continued, one may grope down farther until the uterine artery, whose presence is made known by its pulsations, is found, and this artery may be followed well down to the cervix and may be there ligated, either *en masse*, or in a separate ligature. When the ligature is placed, care must be taken to pass the pedicle needle close to the cervix uteri and the loop should be carried upward and outward instead of outward, before it is finally tied. In this way we avoid inclusion of the ureter. A similar procedure is next followed on the opposite side. The blood supply to the tumour is now shut off, except what little it gets through the azygos vaginæ artery and another small vaginal branch in front. The amputation of the tumour is next effected with a few sweeps of the knife. It occasionally happens that one or two vessels can be seen spouting from the anterior or posterior surface of the stump. These may be tied with small catgut ligatures. If, however, there is nothing but a slight general oozing, the operator will proceed to the next steps of the operation for the control of this hemorrhage.

By means of a small curved needle that cuts on the flat, the wound is stitched up from the bottom with continuous catgut sutures; each stitch is pulled tightly and held taut by the assistant until the next stitch is taken. In this way the stump is gradually built up and puckered in until finally the outermost edges are approximated above just as

the two flaps are brought together after an amputation of the leg. The peritoneum is stitched together over the surface, and this stitching is continued on outward over each broad ligament so that nothing but peritoneum can be seen when looking into the pelvic cavity.

A little hemorrhage may have been found about the downward dislocated bladder. If any vessels persist in oozing here they may be controlled with small catgut sutures. The mere approximation of the bladder back into its old position, produced by the suture of the peritoneal edges before and behind the stump, is usually sufficient to control all hemorrhage. There is sometimes a little oozing for three or four hours after the patient has been placed in bed, and on this account many operators place a glass drainage tube in the cul-de-sac of Douglas from above or from below. If placed below, the vagina is packed with iodoform gauze to keep the drainage tube *in situ.* If the drainage tube is placed in the cul-de-sac of Douglas from above, it should be removed within a few hours after the operation. Considerable blood will drain from it for two or three hours, and then the quantity rapidly diminishes.

The ligatures used on the ovarian and uterine arteries may consist of either catgut or silk. Some operators are not satisfied to use catgut owing to the difficulty experienced in tying it with sufficient firmness, unless the gut is of such a thickness as to make it difficult to completely sterilize it. Silk, if used, should not be any heavier than is necessary to accomplish the purpose for which it is intended. If the silk is of the first quality a much smaller strand can be used than if it is of an inferior quality.

If hemorrhage still continues after the stump has been stitched together in the manner described, it is sometimes necessary to transfix lower down and tie the stump with very strong thread into two sections. This procedure can, however, scarcely be called for if the arteries have been properly ligated in the commencement of the operation. When such hemorrhage occurs, the arteries may be sought for and an effort made to find the presence or absence of pulsation beyond the ligatures. It may even be advisable to throw another ligature around any or all of the vessels to insure their constriction, as the placing of a loop about the whole pedicle may produce sloughing of the tissue. Ross has seen this occur in one case.

Extra-peritoneal Treatment of the Pedicle.—If it is decided to treat the pedicle according to an extra-peritoneal method, the technique of the first part of the operation is exactly similar to that just described. The vessels are ligated and the wire clamp is then passed down around the pedicle, inside of and above the broad ligaments that have now been divided and pushed away. A single or double pin is then pushed through the stump to hold it outside the abdominal cavity and to keep the wire from slipping off the pedicle. The wire is then tightened up and the tumour rapidly removed. The wound is next closed about the stump so that the peritoneal surface of the

stump comes in contact with the parietal peritoneum. The peritoneal cavity is thus shut off by adhesions in a few hours. The bladder must be carefully dissected down and pushed out of the way, in order that injury to the bladder and ureters by the wire of the clamp may be avoided. These unfortunate accidents have occurred on several occasions. Intestine must also be kept well out of the way.

The stump is now tanned with a solution of perchloride of iron and glycerine, and covered with strips of dry lint. The serre-nœud is tightened frequently, and the pedicle sloughs off about the twelfth day, leaving a granulating surface that requires several weeks to heal.

The so-called mummification of the stump is not of very great importance. Even though the stump mummifies, the tissues underneath frequently suppurate.

Another extra-peritoneal method of dealing with the pedicle is that by which it is transfixed and tied with chain suture, and then fastened in the abdominal wound without the use of any clamp. As a consequence of the position of the pedicle, this method prevents union of the abdominal incision by first intention and permits of a subsequent hernia through the abdominal parietes. There is nothing to be gained by leaving the pedicle in this situation. It was supposed that it could be readily lifted up and hemorrhage could be easily controlled, but this has proved to be an unnecessary precaution now that the ligation of the vessels is better understood. A great deal of this sort of surgery can, with profit, be relegated to the past though it has all served a useful purpose.

The ideal operation, described above, is all that can be required for the removal of fibroid tumours where they occupy a position in the fundus, or press outward into the broad ligament or into the pelvis. All can be removed by this procedure with ease and safety by experienced operators. At this stage of our knowledge, it is useless to recount the different methods adopted by different operators during the past ten or fifteen years. Most of these methods have been discarded, or, if they have not been discarded, they should have been.

Panhysterectomy, as the name implies, means the complete extirpation of the uterus. In practice, the ovaries and Fallopian tubes are generally, although not always, removed with the uterus. A number of operators recommend in this, as in other operations for the removal of the uterus, that an ovary, if entirely healthy, be left *in situ*, for the purpose of maintaining the menstrual molimen and of mitigating the nervous symptoms that frequently follow complete ablation of the genital apparatus.

The technique of this operation, as practised by Ross, is similar to that described for the removal of the myomatous uterus by supravaginal amputation. The cervix may readily be removed after the tumour has been cut away and is no longer obstructing the view. The

vessels supplying the cervix are the same as those supplying the vaginal wall at its junction with the cervix, provided that the blood supply from the uterine arteries has been cut off. We may, therefore, expect to find the azygos vaginæ artery spouting when the vaginal

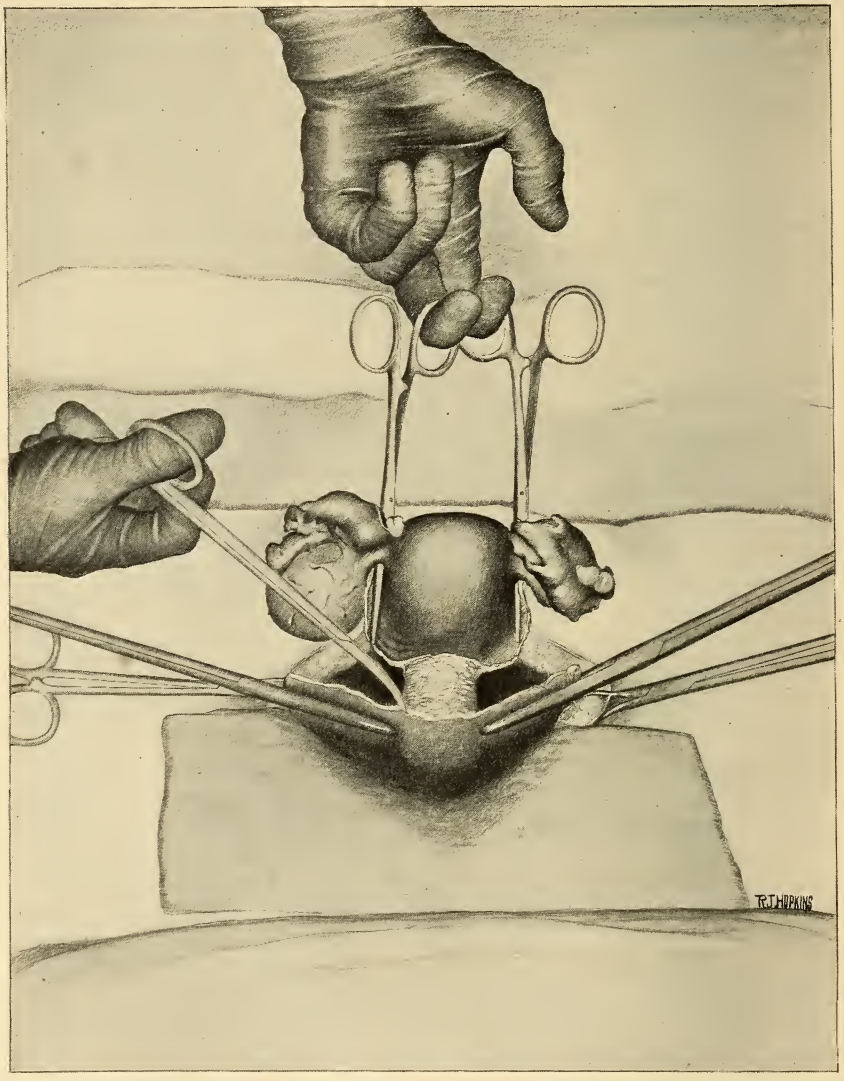

Fig. 172.—"The small clamps attached to the uterus are now hooked up by two fingers of the left hand, by which traction is made."—Reed (page 417).

septum is cut through at its junction with the cervix in the neighbourhood of the cul-de-sac of Douglas. No vessels of importance will bleed on either side, but another small branch or two will be found

spouting in the vaginal septum, where it is separated from the uterine neck in front. These vessels can be readily ligated with catgut.

Reed's operation of panhysterectomy is as follows: All adhesions of the uterus and its appendages are first broken up and the uterus is lifted up into the abdominal incision. In some cases this manipulation can be done so satisfactorily with the patient upon her back that it is unnecessary to put her in the Trendelenburg position, although in most cases the latter posture is not only desirable but necessary. The broad ligament is then clamped upon one side, just beneath the ovary and Fallopian tube, the clamp extending from the margin of the broad ligament to the side of the cervix. Another and smaller clamp is now placed on the broad ligament parallel with the previous clamp but a quarter of an inch nearer to the uterus. The broad ligament is then divided between the clamps, from its edge to the side of

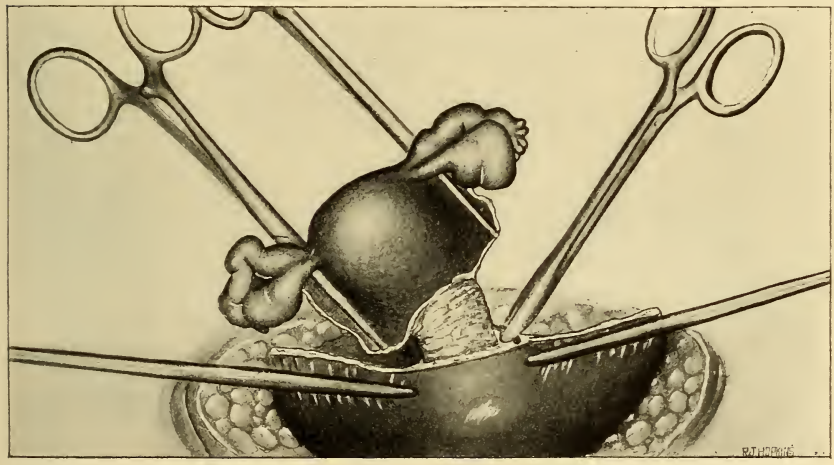

Fig. 173.—"The uterine arteries which can be seen and clamped as soon as they are reached."—Reed.

the cervix; the broad ligament on the other side, is similarly clamped and incised. The vesical fold of the peritoneum is now dissected away from the front of the uterus, as is the peritoneum covering the posterior side of the organ. The small clamps attached to the uterus are now hooked up by two fingers of the left hand, by which traction is made (Fig. 172). As the uterus is drawn away from the vagina, the dissection is made by means of the scissors held in the right hand. Care should be taken in making this dissection to avoid wounding the uterine arteries, which can be seen and clamped as soon as they are reached (Fig. 173). From this time on, the dissection should be carried even more closely to the cervix, dividing the cervical tissues sufficiently to leave a slight ring *in situ* after the cervix is withdrawn. If this precaution is not taken, there is liability of wounding the azygos vaginæ

artery, the hemorrhage from which, while controllable, is embarrassing. When the vagino-cervical juncture has been reached, the point of the closed scissors may be thrust through into the vaginal canal. After this preliminary opening, the remaining division of the vaginal mucosa is accomplished with facility. The ovarian and the uterine arteries upon either side are next tied individually by means of formalinized catgut. All clamps are now removed, and the field of operation is inspected to make sure of complete arrest of the bleeding. If this is duly controlled, a piece of sterilized gauze is packed into the vagina from above, the upper part of the pack coming within and above the cut margins of the vaginal mucous membrane. The peritoneal margins are stitched together by means of a continuous catgut suture. Finally, the toilet of the peritoneum is made by means of dry sponging, and the incision is closed by laminated sutures. (See Abdominal Section.) The specimen removed will show a complete uterus with the appendages and the exact area of the dissection (Fig. 174).

If it is desired to use the angeiotribe for hemostasis, it can be applied just beneath the temporary clamp, which is then removed.

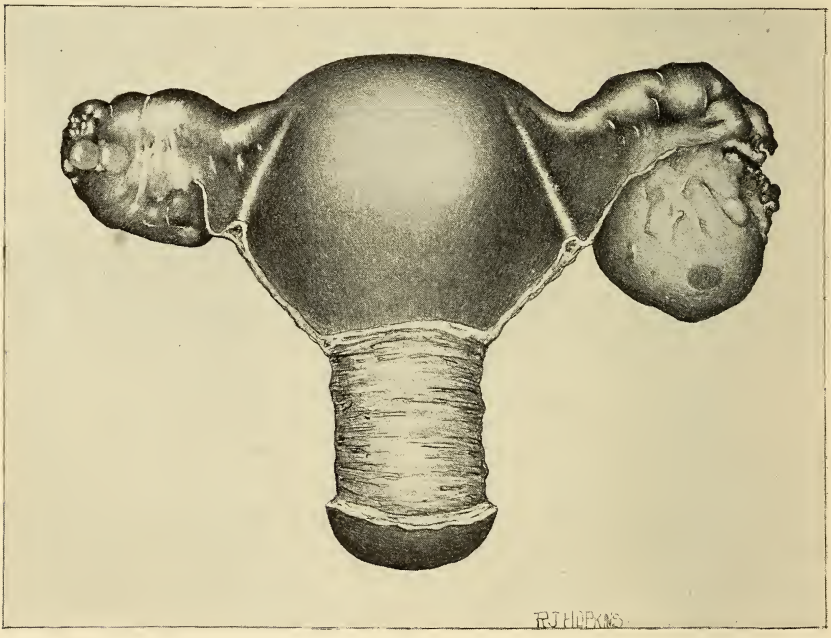

Fig. 174.—"The specimen removed will show a complete uterus with appendages and the exact area of the dissection."—Reed.

Care should be taken that the end of the angeiotribe shall embrace the uterine artery within its clasp (Fig. 175). The instrument should be left on a few minutes, when it can be applied similarly to the other side. Doyen, who invented the angeiotribe, does not trust it

alone to control hemorrhage under these circumstances, but applies a supplementary ligature, asserting as a sufficient advantage for using the instrument that it diminishes the volume of the tissues and renders less liable slipping of the pedicle. The electric clamp of Skene may

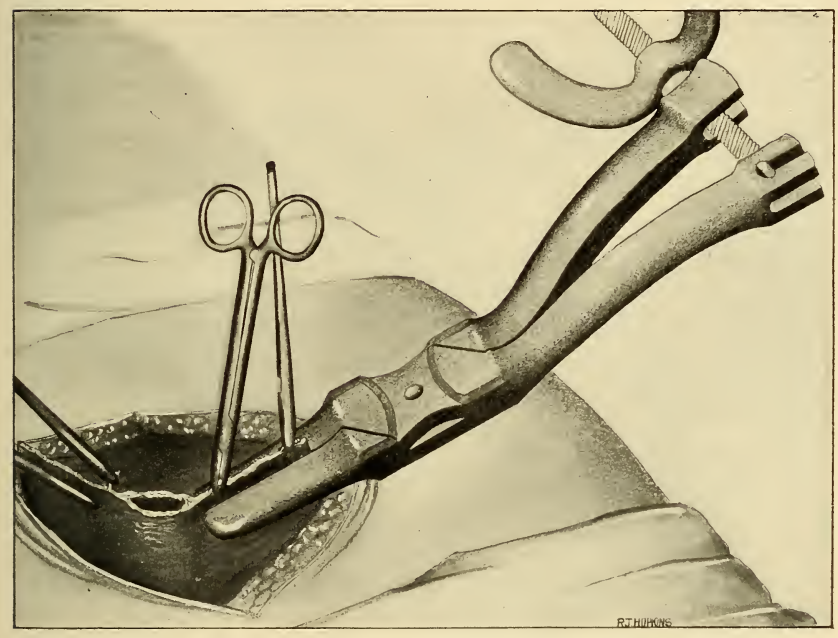

Fig. 175.—"If it is desired to use the angeiotribe for hemostasis, it can be applied just beneath the temporary clamp, which is then removed. Care should be taken that the angeiotribe shall embrace the uterine artery within its clasp."—Reed (page 418).

be similarly employed (see Hemostasis), but whether forcipressure or heat is applied for hemostasis, the peritoneal margins should be stitched together to avoid retraction.

The *advantages* of panhysterectomy are (*a*) the contamination of the field of operation, which is so liable to happen as the result of extension of infection from the endocervium in cases of supravaginal amputation, does not occur; (*b*) drainage by the vagina is easily and thoroughly accomplished; (*c*) with care in avoiding the azygos vaginæ artery, hemostasis is readily secured and safely maintained. The resulting condition of the pelvic diaphragm is one of equal, if not greater, strength than that secured by the supravaginal operation; (*d*) if the technique above described is carefully followed, the operation is done with greater facility than are others devised for the extirpation of the uterus; (*e*) myomatous uteri of considerable magnitude may be removed, *en masse*, by this means (Fig. 176).

Vaginal hysterectomy is sometimes practised for the removal of small diffuse myomata of the uterus, associated with persistent and

uncontrollable hemorrhage. The technique of the operation does not differ from that described in connection with malignant neoplasms of the uterus. (See Vaginal Hysterectomy.)

Vaginal Myomotomy.—(*a*) *Enucleation* (technique).—The tumours most appropriate for enucleation are small and medium-sized, single

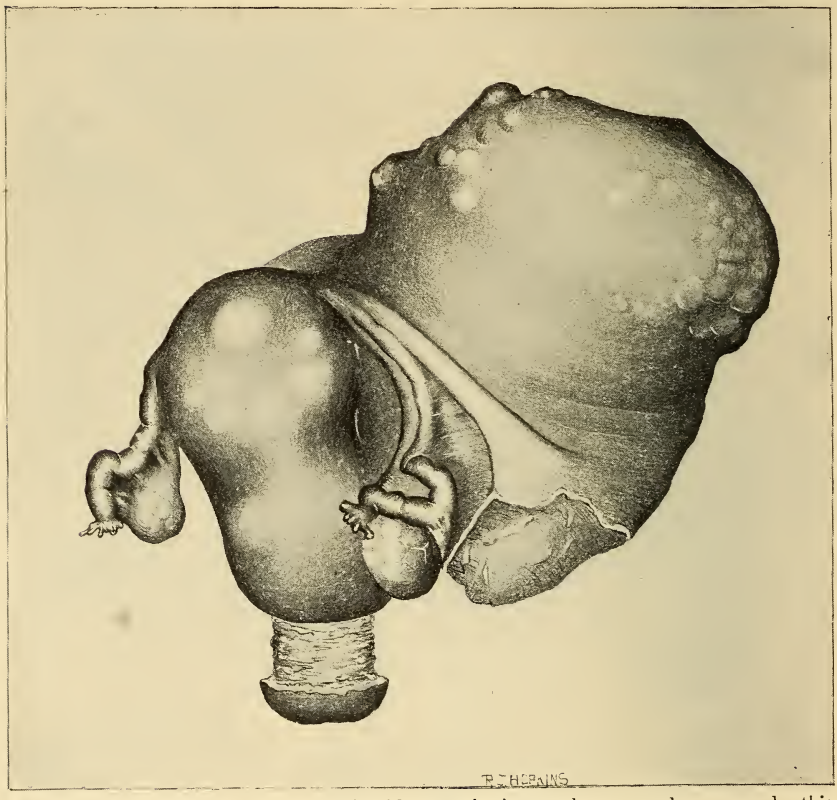

Fig. 176.—"Myomatous uteri of considerable magnitude may be removed, *en masse*, by this means."—Reed (page 419).

submucous tumours that are not pedunculated, and interstitial tumours distinctly encapsulated and projecting well into the cavity; also large tumours projecting into the os or partly extruded from the same. Very large tumours, if removed by vaginal myomotomy, are best extirpated by *morcellement* or by combined *morcellement* and enucleation.

The cervical fibroids requiring enucleation are of rare occurrence. They may be extirpated as a rule without difficulty. After exposing them by means of a Sims's speculum and retractors, an ample incision is made through the covering of the tumour, which covering is separated from the tumour with the finger or handle of the knife (Fig. 177); then the uncovered portion of the tumour is seized with a strong volsella forceps and traction upon, and rotation of, the neoplasm is made, while

the finger is inserted between the tumour and its envelopes, to sever its cellular connections. Should there be any dense bands of tissue extending from the tumour into the underlying tissues, they should be severed with scissors. Emmet's right-hand, lesser-curved, blunt-pointed scissors, serve as an excellent substitute for the finger, and are ready at hand if needed to sever any bands. No great difficulty presents and there is as a rule little hemorrhage. If needed, hot-water irrigation and packing the cavity with gauze will arrest bleeding.

When the neoplasm to be enucleated is situated within the uterine cavity, it is a matter of the first importance that the os be widely dilated. This may be effected by laminaria tents, the steel dilator, or by lateral incisions of the cervix. The last method is preferable. The various steps of the operation may be stated as follows: The patient is placed in the dorsal position, with legs in holders or feet secured in the high stirrups, and with buttocks projecting slightly beyond the edge of the table. She has been previously prepared. Wash out the vagina again with a bichloride solution; retract the perineum with a self-retaining speculum, preferably a Jones's with a short blade. Now seize the anterior lip of the cervix with bullet forceps and pull down the uterus. Incise the os with scissors or knife. Examine the tumour to determine its size and location, make ample incision through its covering over the most dependent accessible part. Separate the envelopes from the tumour for a short distance, and seize the neoplasm with a strong short-tined volsella or Museux forceps. Now proceed as indicated in describing the method of enucleating the cervical fibroid. Thomas's serrated spoon saw (Fig. 178) will often be found serviceable in loosening the tumour attachments. Con-

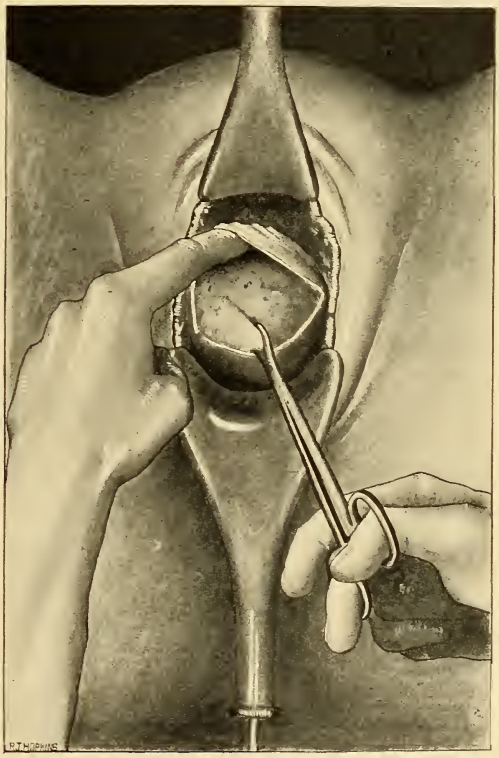

Fig. 177.—"An ample incision is made through the covering of the tumour, which covering is separated from the tumour with the finger or handle of the knife."—Dunning (page 420).

siderable force may be required to dislodge the tumour. Strong traction may be employed, but the danger of lacerating the uterine walls or producing inversion of the organ, must be borne in mind. If the tumour is too large to be delivered whole, it may be cut into sections and removed piecemeal.

Fig. 178. "Thomas's serrated spoon saw." —Dunning (page 421).

(*b*) *Morcellement.*—When the tumour is very large, this method may be employed in preference to enucleation. Emmet is given the credit of priority in describing and putting into execution a systematic method of vaginal myomotomy by *morcellement.* It has often been denominated Emmet's traction method, but it comprises most of the essential features of what is known to-day as vaginal extirpation by *morcellement.* It differs from enucleation in that after dilatation of the os, no effort is made to divide the capsule of the tumour, and sections of the neoplasm are made in the vagina. The neoplasm is seized at its lower portion with strong hooks or volsella forceps and forcibly drawn downward. As it descends into the vagina, portions of the tumour are cut away and removed, the remaining portion is again seized and powerfully drawn upon, and once more the presenting part is cut away. And so the process is carried on, until finally the base of the tumour is reached. It will now be observed that, in consequence of the powerful traction, a pedicle has been formed which, in some of Emmet's cases, was no larger than the index finger and consisted of the coverings of the tumour. This base is severed and the last of the tumour is removed. The traction upon the tumour stimulates uterine contraction, so that as the tumour descends, the uterus follows, closely encircling the neoplasm. If necessary, the descent of the uterus may be aided by pressure upon the fundus from above the pubes. Injections of hot water into the cavity of the uterus may be made if needed to stimulate contraction or to arrest hemorrhage. In case of profuse hemorrhage during the process of extirpation, the tumour should be removed as quickly as possible, hot-water injections employed, and later, if necessary, gauze packing.

Fig. 179.—Péan's forceps for *morcellement.*—Dunning (page 423).

Péan's method of *morcellement* differs little in principle from Emmet's, the chief differences being in the use of specially devised instruments (Fig. 179), the preliminary severing of the vaginal and other attachments of the cervix as high as the lower margin of the tumour, and the excision of the lips of the cervix and application of pressure forceps to bleeding vessels within the uterine cavity, if the hemorrhage is profuse.

The following is a brief summary of Pozzi's (*Medical and Surgical Gynecology*, vol. i, pp. 267–272) excellent and elaborate description of Péan's method:

1. Liberate the cervix by circular incision. Check hemorrhage by application of pressure forceps.

2. Incise the cervix bilaterally from the cervical canal. Incise the lower segment of the uterus if necessary to the level of the tumour.

3. Seize the anterior and posterior lips of the uterus with forceps and draw the organ toward the vaginal outlet.

4. Seize the most accessible portion of the tumour with forceps, drag it downward and cut off a section. Seize the accessible portion again, drag downward and cut away another piece. Repeat this procedure until finally the remainder of the tumour comes within reach. Now, if pedunculated, sever the pedicle and remove the last of the tumour. If more easily effected, enucleate the remaining mass. Search for other tumours; if any are found, extirpate them in like manner. If there is no hemorrhage, irrigate the uterine cavity with a hot antiseptic solution and place one or two strips of gauze for drainage. Stitch the incised cervix. Stitch the incised vaginal walls to the cervix and pack the vagina lightly with gauze.

If there is prolonged hemorrhage not checked by hot irrigation, excise the lips of the cervix, draw the uterus down to the vaginal outlet, mop out the uterine cavity, seize the bleeding vessels with long catch forceps and pack the uterine cavity lightly with gauze. As a final step, stitch the lower end of the uterus to the incised vaginal walls.

Both Emmet's and Péan's operations in cases of large tumours are formidable and may in many instances be rejected in favour of vaginal or supravaginal hysterectomy. They are contraindicated when the uterus contains several tumours, and when there is suppurative disease of the uterine adnexa.

In view of the fact that foci of fibroid development may, and often do, exist in such size and localities as to defy detection in the remaining uterine wall; and in view of the frequent recurrence of fibromyomatous growths in uteri which have been subjected to myomectomy, many operators, with good cause, reject the latter operation. It is undeniable that hysterectomy is to be preferred in the majority of cases. It is argued that myomectomy is always a serious operation, that, as already stated, it often fails to bring the patient immunity, and that there is difficulty in detecting other commencing growths. This

is all avoided by hysterectomy, the immediate dangers from which are no greater than from myomectomy. It is true that a few women have conceived and borne children after myomectomy, but this result is rare; sterility or, in the event of conception, abortion may be set down as of commoner occurrence.

Extirpation of Polypoid Growths from the Uterus.—The method of removal of a small polypus attached at or near the external os is simple. With a strong, long-handled catch forceps seize the pedicle near its attachment, and by traction on and rotation of it, the attachment is broken up. But little force is required, and little bleeding need be feared, unless too strong traction has been exerted. Should hemorrhage appear, it is best to cauterize the bleeding surface, if accessible, with the thermo-cautery. If the pedicle is broad and the polypus vascular, incise the base with scissors and cauterize the cut surfaces with the thermo-cautery.

When the polypus is large, distending the vagina and obscuring a view of the pedicle, the point of attachment and the size of the pedicle should if possible be determined. This can usually be effected by a digital exploration, or, if the polypus is too large to permit this, a bent uterine sound can usually be carried round and above the polypus, when, by manipulation, the attachment can be felt and its size estimated. The loop of the wire écraseur may be carried around the tumour and the whole instrument gently carried upward toward the cervix. If a strand of piano wire is used, there is usually little difficulty in encircling the pedicle. By leaving one end of the wire unfastened until the pedicle is reached, it may then be drawn tight and the unfastened end of the wire wrapped around the post of the écraseur, when a few turns of the screw will sever the pedicle.

Sometimes the polypus will be so large that difficulty is experienced in delivering it. Two courses are then open—namely, section of the tumour and its delivery piecemeal, or the application of an obstetrical or a specially designed forceps with which to make traction.

When the attachment of the pedicle is above the internal os and the tumour presents at the external os or protrudes into the vagina, the polypus may frequently be seized with a forceps or tenaculum, traction made upon it, and the pedicle cut with scissors. No fear of hemorrhage or recurrence of the polypus need be entertained. If the polypus is wholly within the internal os, it is probable that the tumour is large or the pedicle short. To accomplish its removal, the cervical canal should be dilated by the steel dilator, or the cervix may be incised and subsequently dilated by the finger or steel dilator. None of these procedures is objectionable if conducted under antiseptic precautions. With the cervix dilated, the anterior lip may be seized with a double tenaculum, the uterus drawn down, and the interior of the uterus explored with the finger.

In this way small polypi may be located and scraped off with a

sharp curette or cut off with long blunt scissors. It has been Dunning's practice for many years when the pedicle could be distinctly located and safely reached by blunt-pointed scissors to sever it with scissors in all cases of uterine polypi attached above the internal os. Should the tumour be very vascular and contain a large artery, a safe and feasible plan is to seize the pedicle in the bite of a long-curved pressure forceps and sever it between the forceps and the tumour. The forceps should be allowed to remain attached to the stump of the pedicle for two days. A large polypus with a short, thick, pedicle attached high up can be best extirpated by severing the pedicle with a wire écraseur.

In all cases of intrauterine polypi, after the removal of one polypus the cavity of the uterus should be explored, for occasionally more than one growth is present. Should hemorrhage follow the extirpation of the polypus from this region, the intrauterine douche of hot water will usually arrest it. Vinegar, in proportion of 1 to 3 or 1 to 2 is a valuable addition to the douche. If these plans fail, the uterine cavity should be packed with plain sterilized or chemically asepticized gauze. The operators may choose between the Sims and dorsal positions. Dunning and many other operators prefer the latter, with the limbs in the holders and the cervix exposed by a short, broad, Sims's or Jones's speculum. The removal of malignant polypoid growths has not been considered in the foregoing remarks. They are best treated by total extirpation of the uterus. (See Malignant Neoplasms of the Uterus and Vaginal Hysterectomy.)

CHAPTER XXIX

NEOPLASMS OF THE UTERUS (Continued)

Malignant neoplasms: (*a*) Syncytioma malignum; (*b*) adenoma; (*c*) sarcoma; (*d*) carcinoma—Treatment: (*a*) Palliative: topical medication, curettement, high amputation; (*b*) radical: vaginal hysterectomy; abdomino-vaginal panhysterectomy; the extended operation; electro-hysterectomy—Results.

Malignant Neoplasms of the Uterus

These will be considered in the following order: (*a*) syncytioma malignum, (*b*) adenoma uteri, (*c*) sarcoma uteri, (*d*) carcinoma uteri, (*e*) exceptional forms.

These growths, while differing in their histogenesis and in their histologic properties, have in common the clinical feature of malignancy; they are, therefore, neoplasms which, if left to themselves, will kill the patient by progressive invasion of tissue and by local and constitutional conditions that are thereby established. These changes will be described in detail in connection with the different diseases. It is desirable, in this preliminary paragraph, to emphasize the statement that the treatment of malignant neoplasms, to be curative, must involve the complete eradication of the growth. In view of the inherent tendency of these growths to invade the neighbouring tissues, some slowly, others rapidly, the operation should, manifestly, be undertaken as soon as the malignant character of the growth is determined. So long as the neoplasm remains within operable limits, nothing short of its complete extirpation should be contemplated or attempted. When, however, it has passed the operable limit, and has invaded structures and organs that can not be dealt with surgically without an immediate fatal issue, the patient should be subjected to palliative treatment. The rule formerly entertained and adopted, that mild measures should be employed in incipient cases and radical measures only in advanced cases, should in the interest of humanity be absolutely reversed.

Syncytioma malignum, known also as *deciduoma malignum*, *malignant placentoma*, *carcinoma syncitiale*, *sarcoma deciduo-chorio-cellulare*, *deciduo-sarcoma*, *chorio-epithelioma*, is a degenerative malignant disease of the sarcomatous type, originating in the decidual structures of the pregnant woman, and tending to a rapidly fatal issue (Fig. 180).

Maïer published in *Virchow's Archives* for 1875 two observations on tumours of the body of the uterus; the tissue composing the tumours

was distinctly decidual in character. Hegar subsequently reported the death of one of these patients from what he considered to be cancer of the uterus. Sänger, in 1888, was the first to demonstrate this disease, and, in 1893, to draw attention to its essential histogenetic character and to its pronounced malignant tendency. A number of cases have since been reported in various countries, and special studies of the disease have been made by Whitridge Williams in America (*American Journal of Gynecology and Obstetrics*, June, 1895), and Roger Williams in England. Maurice Cazin (*La Gynécologie*, February, 1896) made a careful study of the disease and did much to elucidate its pathology. The literature of the subject has already grown voluminous.

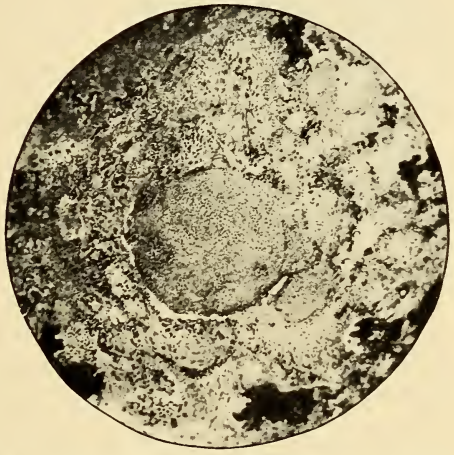

Fig. 180.—"Syncytioma malignum . . . is a degenerative malignant disease of the sarcomatous type."—Herzog (page 426).

Pathology. — These tumours of the uterus when first observed gave rise to a great deal of confusion as to their true nature and histogenetic classification. There are not yet a great many cases of this kind on record, because our attention has only recently been drawn to them. Syncytioma is found in the uterus after delivery at full term, abortion, or mole pregnancy. It forms soft tumours, bleeding easily, variable in size, generally roundish and small, very malignant, and with a tendency to form early distant metastases. The subject of these tumours has been treated in our country in articles by Bacon, Williams, and Gaylord. These neoplasms are derived from the chorion epithelium of the placenta and they are therefore of fœtal origin. On account of this fact they form one of the most peculiar malignant neoplasms met with. We have here a tumour spreading in the mother, which has taken its origin from fœtal structures. There are of course quite a number of writers who assert that the syncytium of the placenta is of maternal origin. Herzog, from his own work on the histology of the placenta and from the recent contributions of Van Heukelom, His, Peters, and others, is convinced that the syncytium is derived from the fœtal ectoderm, and he therefore classifies *syncytioma malignum* under epiblastic epithelial neoplasms.

Histology.—The tissue of these tumours shows protoplasmic masses in which are seen many nuclei, without, however, any cell boundaries being recognisable. These masses very much resemble syncytial buds (Fig. 181). There are also found cells having the character of those

of the Langhan's layer of the normal placental villi. Between the tracts of tumour cells are large open spaces filled with blood, and resembling more or less in character the intervillous spaces of the placenta. The syncytioma malignum, in other words, represents to a certain extent an atypical imitation of normal placental tissue. There are sometimes present whole chorionic villi, but all the tumour cells and structures always deviate from the normal placental type by marked anaplastic features.

Fig. 181.—"These masses very much resemble syncytial buds."—Herzog (page 427).

The *causes* of this disease are obscure. It is a suggestive fact, however, that of the 15 cases tabulated by Marchand, 12 gave clear histories of previous "mole" pregnancy. Macnaughton Jones states that hydatidiform mole has been observed in 45 per cent of the cases. The conclusion is, therefore, forced upon us that this form of intrauterine infection predisposes to the disease, which conclusion may further prove suggestive in regard to the general bacterial or parasitic origin of malignant diseases. Beyond this suggestive fact, the etiology of malignant degeneration of the decidual structures is shrouded in as deep a mystery as that of other malignant diseases.

The *symptoms* of syncytioma malignum can not be said to be pathognomonic. The most significant symptom is severe, intermittent hemorrhage, following labour or abortion. This may occur immediately after the uterus has been emptied; or it may be delayed for some time, in which case its onset will be attended by the discharge of an hydatid mole. After the hemorrhage ceases, a foul-smelling dirty-coloured watery discharge generally ensues. Pain may or may not be present; but when it does exist, it is frequently provoked by efforts of the uterus to expel clots. The patient is generally cachectic, loses flesh rapidly, and speedily shows signs of advanced anæmia. Exploration of the pelvis will reveal a uterus more or less enlarged, even beyond what might be expected under ordinary circumstances at the same period following delivery. The cervix is generally found open, although this is far from a constant condition. Digital exploration of the uterine cavity will reveal coagula beneath which are found soft vegetating masses. Cazin calls attention to the fact that the neoplastic products are frequently of such consistence that they may easily be mistaken for clots. The enlarged uterine wall is œdematous and nonresistant, and may, therefore, be perforated with facility in the course of examination.

The *diagnosis* of syncytioma must depend, so far as the clinical features of the case are concerned, largely upon the history of

pregnancy followed by parturition at term or by abortion; or, particularly, the history of hydatid mole. Due attention should be given to the symptomatology just recorded; the exact character of the generative process, however, can be determined only by microscopic examination of some of the tissue. This may be easily removed in some cases by the finger, in others by the curette. Another diagnostic sign of importance in cases of longer standing is the occurrence of metastases. These migrations, in consequence of the special tendency of this disease to invade the blood vessels, are manifested at an earlier stage than in other malignant diseases of the uterus.

The *treatment* must consist of nothing short of the complete removal of the uterus and adnexa. (See Vaginal Hysterectomy.) This should be done as quickly as the diagnosis can be made. It should be remembered, however, that metastases occur very early in the history of these cases, and that, if their existence is detected, the operation offers the patient no hope and is, therefore, unjustifiable. Roger Williams tabulated 14 cases of this disease that had been treated by vaginal hysterectomy; of these, 12 recovered from the operation, while 2 died; of the 12 primary recoveries, 5 died with recurrence within the first year; 6 of the remaining 7 were free from recurrence ten, nine, seven, seven, five and one half, and three months, respectively, after the operation; nothing was said of the after-condition of the other patient.

Adenoma uteri, otherwise designated *adenoma malignum*, or *adenoma malignum carcinomatosum uteri*, is a malignant degeneration of the endometrium possessing individual characteristics but having a tendency to assume the carcinomatous type.

To Matthews Duncan probably belongs the distinction of first having directed attention to this disease, although at the time of his first report its histogenetic character was not recognised. Breisky and Eppinger reported undoubted cases in 1877, at which date the real literature of the subject commences. Veit was the first to demonstrate that what appeared primarily to be simple, benignant adenoma, might become a veritable adeno-carcinoma possessing all the characters of malignancy. In America, Thomas and Goodell were among the first to report cases of apparent malignant adenoma, while Mann was among the first to give a clear elucidation of the disease. Coe's contributions to the subject have been of great value.

This neoplasm is looked upon by Herzog as probably not different from a carcinoma of a more common type, although it shows such characteristic histologic features that it is now generally classified separately. Glandular hypertrophy of the uterine mucous membrane may reach a very high degree, so that one might feel inclined to speak of it as an adenoma; and it has been asserted that such extensive glandular hypertrophies have a tendency to change into an adenoma malignum. Yet this assertion so far lacks proof. Typical adenoma malignum of the uterus, as shown in Oliver's case (Fig. 182), does not, as a rule, present a well-circumscribed tumour, but a general diffuse

thickening of the mucous membrane which has an irregular, juicy, velvety appearance. The uterus is generally moderately enlarged in all its dimensions. In very high degrees of glandular hypertrophy, we find the uterine glands often quite tortuous, divided twofold or threefold and invaginated upon themselves. In adenoma malignum the picture becomes still more complicated. The rapid proliferation of the glandular epithelium leads to one of two conditions. Either the newly formed epithelia grow toward the lumen of the gland, and in their growth carry inward toward the glandular axis the basement membrane, *adenoma malignum invertens* (Fig. 183); or they grow outward, away from the axis, and then an *adenoma malignum evertens* is formed. Of course these two types may be more or less combined. It is not easy to form a clear conception of the microscopic picture of these tumours even from a very minute description. Gebhard (*Pathologische Anatomie der Weibliche Sexualorgane*, 1899), describing them in detail, states that nobody, even after studying a full description, should imagine himself able to distinguish every adenoma malignum from a glandular hypertrophy. Only a good deal of microscopical experience can give safety in this respect. Herzog, who has examined several cases of adenoma malignum, saw one among them operated on by Henrotin which showed a very interesting histologic combination. The uterine mucosa showed the typical picture of an adenoma malignum, except in those parts where the tumour had extended into the cervix. Here were found regular solid alveolar cell nests, and it appeared that the epithelia were squamous in character. Herzog believes that there existed primarily an adenoma malignum of the corporeal mucosa. The

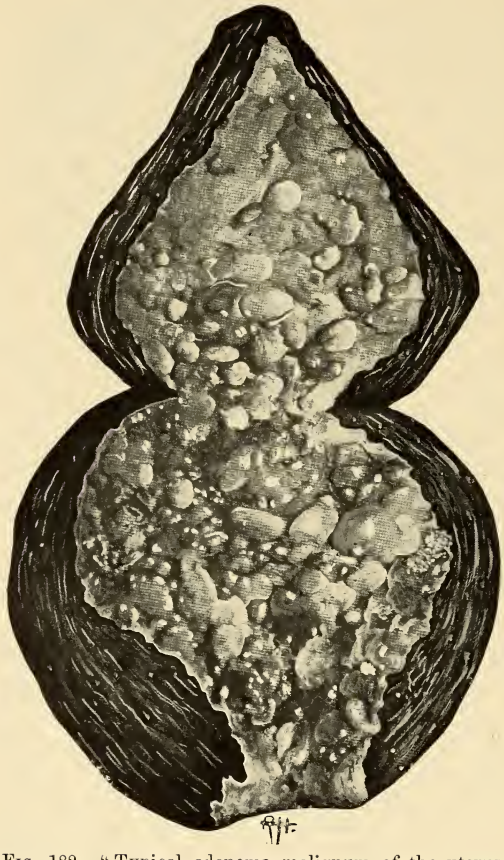

Fig. 182.—"Typical adenoma malignum of the uterus as shown in Oliver's case."—Herzog (page 429).

malignant process secondarily infected the cervical mucosa where it localized itself in squamous epithelia present there, either by a process of metaplasia or by one of substitution.

The *symptoms* of adenoma uteri are not clearly defined, none of them being characteristic of the disease. The first fact of importance is the relative chronicity, adenoma being the least active of the various malignant degenerations of the uterus. The patient will, therefore, give a history covering a longer period of time than would be the case if she were afflicted with carcinoma. Coe maintains that there is less pain, that the hemorrhages are less frequent and less profuse, and that the intervening watery discharges are less offensive, than in carcinoma. The disease is not prone to metastatic manifestations, which occur late, if at all. They were entirely absent in four of Coe's cases. The *diagnosis* depends upon the symptomatology above indicated, and upon the detection of papillomatous growths in the interior of the uterus. If uterine scrapings are examined by the microscope the result is likely to be negative, which would not be true if the disease were carcinomatous. Adenoma is an insidious disease that runs a slow course of invincible malignancy. It is important that the relative good health sustained through a long period by patients with this disease, should not be construed as an evidence of even a tendency to recovery. The profuse hemorrhages, the intervening discharges, the pain and tenderness, may disappear for a time, only to return a little later with added violence.

Fig. 183.—"The newly formed epithelia grow toward the lumen of the gland, and in their growth carry inward the basement membrane."—Herzog (page 430).

The *treatment*, to be on the side of safety, should be arranged without reference to any remaining pathological question relative to the existence, respectively, of benign and malignant adenomata, and should be based upon the axiom of Coe, viz.: "There is only one variety of true adenoma of the corpus uteri, and that is, both clinically and anatomically, malignant." In no other way can a patient be given the benefit of the doubt, at least, until the pathologists themselves can distinguish between the two alleged varieties, and can furnish to the practitioner the criteria by which he can tell the one from the other. Repeated curetting is conceded to augment the malignancy of the disease, while the use of the galvano-cautery is equally objectionable. Complete ex-

tirpation of the uterus is the only means that offers safety to the patient. (See Vaginal Hysterectomy.) The tendency to recurrence after operation is less in this than in other malignant diseases of the uterus.

Sarcoma uteri is a malignant neoplasm having its origin in the connective tissue of the uterus, and is characterized by an atypical proliferation of connective-tissue cells in a fibrous stroma. It occurs less frequently than carcinoma of the uterus. The first case was described by Mayer in 1860, the diagnosis being confirmed by a microscopic examination of the specimen by Virchow, but nine cases were recorded during the next eleven years. Since that time, however, much attention has been given to the subject, and the condition has a definite place in pathology and surgical therapeutics.

Sarcoma of the uterus is not a disease of relatively frequent occurrence. Franqué reports only 16 sarcomata to 304 carcinomata of the uterus out of 3,366 cases seen during ten years at the Würzburg gynecological clinic.

It occurs as a rule in middle and later life, but there have also been reported some cases in very young children. (See Causes.) It may develop primarily in the mucous membrane or in the muscular coat. Its seat may be the vaginal portion of the cervix, the cervix proper, or the body. The latter is more frequently the seat of sarcoma than the other parts of the womb. Sarcoma of the mucous membrane forms flat, irregular, roundish, or polyplike masses. In some cases the malignant new growth may spring from a small circumscribed spot and form a growth which macroscopically can not be distinguished from an ordinary polypoid hypertrophy of the mucous membrane. It is of practical importance to keep this in mind, because there are several examples on record where such harmless-looking polyps were removed, a microscopic examination not being made. Shortly after removal, quite unexpectedly, a rapidly growing malignant sarcoma made its appearance. Microscopic examination of such polyps will, of course, reveal their nature. Sarcomata of the uterine mucous membrane are as a rule quite soft in consistence and have a tendency to spread rapidly. They may develop in the uterine cavity and even become pedunculated,

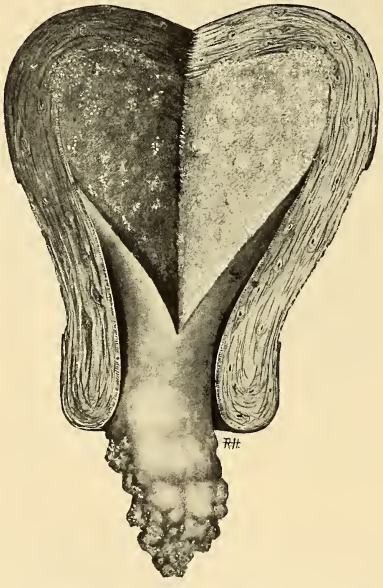

Fig. 184.—"They may develop in the uterine cavity and even become pedunculated, as shown in a case of Reed's."—Herzog (page 433).

as shown in a case of Reed's of which George E. Jones made a sketch (Fig. 184). They then infiltrate the muscularis diffusely, and, when at the same time superficial sloughing takes place, as it frequently does, one is not able to ascertain definitely whence the malignant neoplasm originally started. A peculiar form of sarcoma of the mucosa is one sometimes found arising from the cervix. These sarcomata are of a papilliferous type, and, since the papillæ are hypertrophic, the whole growth looks very much like a hydatid mole. Primary sarcoma of the uterine wall generally begins as multiple nodules or roundish masses. It likewise usually rapidly infiltrates the muscularis and the mucosa and soon leads to destructive processes in the latter. These malignant connective-tissue tumours, when growing in the uterus, frequently have the tendency to close the os internum in a valvelike manner. This leads to one of the constant objective symptoms of sarcoma of the uterus, namely, periodical discharges of an accumulated bloody-watery fluid. Sarcoma of the uterus spreads by continuity and not infrequently leads to a marked enlargement of the uterus in all its dimensions. There may, however, also occur a thinning of the uterine wall with inversion. Such a case has been reported by R. Williams. Distant metastases sometimes take place. Secondary sarcomatous degeneration of primarily benign myomata has been mentioned above.

The *histology of sarcoma uteri* is that of these malignant connective-tissue tumours in general. The neoplasm may be composed of small or large round cells, spindle cells, and giant cells. The tumour cells as a rule take their origin from the adventitia of blood vessels, and they proliferate diffusely in an infiltrating manner. A regular alveolar structure, like that of carcinoma, is rarely found. The sarcomatous tissue is very rich in blood vessels and free hemorrhages are found. It is sometimes difficult to distinguish a beginning sarcoma of the mucous membrane from a profound endometritis interstitialis. The expert, however, will be able to make a diagnosis from the finer cytologic characteristics of the neoplasm. In sarcoma of the uterus, the tumour cells show marked variation in size and shape and they present atypical karyokineses, such as multipolar figures, hyperchromatoses, nuclear fragmentation, etc. (Fig. 185). Herzog (*Transactions of the*

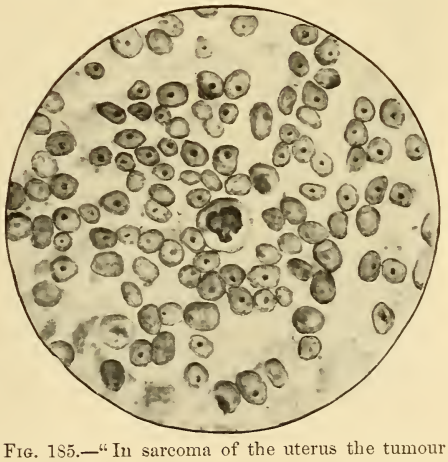

Fig. 185.—"In sarcoma of the uterus the tumour cells show marked variation in size and shape, and they present atypical karyokineses."—Herzog.

Chicago Pathological Society, vol. iii, 1899) has described a sarcoma of the uterus showing a number of interesting histologic features; among them numerous atypical karyokineses and the presence of a large number of phagocytic cells. These, which are not to be confounded with leucocytes, are large tissue cells in the interior of which lymphocytes, leucocytes, and red blood corpuscles, intact or in various stages of dissolution, are found.

Secondary degenerations in sarcoma of the uterus are usually marked and appear quite early. Hemorrhage is one of the most con-

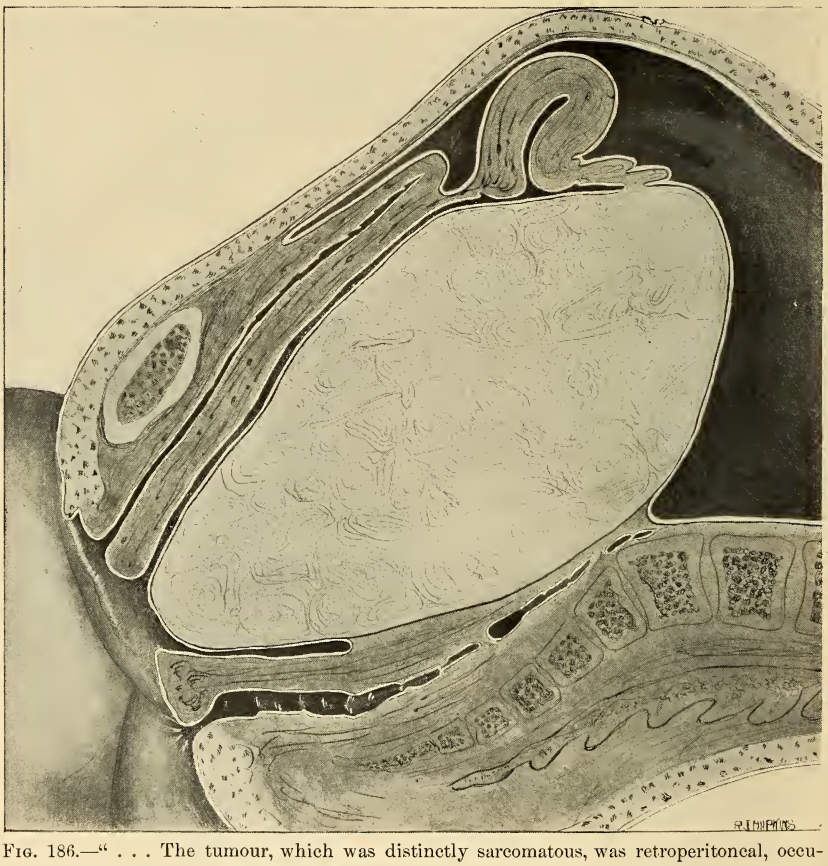

Fig. 186.—" . . . The tumour, which was distinctly sarcomatous, was retroperitoneal, occupied the whole pelvis, and lifted the uterus quite to the umbilicus."—Reed (page 435).

stant occurrences and it leads to the destruction of the neoplastic tissue. Besides such apoplectic destruction we find fatty, hyaline, and colloid degeneration.

Our knowledge of *endothelioma* of the uterus is still very meagre. Cases have been reported by Amann, Braetz, Gebhard, Grape, McFarland, Pick, and Veit. These malignant tumours, in their macroscopic

characters, are similar either to the sarcomata or to the carcinomata. The cases reported occurred in women between the ages of eighteen and fifty-two years. The endotheliomata take their origin from vascular or lymphatic endothelial cells, and are more or less alveolar in structure.

The researches of Kleinschmidt and Kahlden indicate that sarcomata may arise from the connective-tissue elements of the blood vessels and lymphatics in the parenchyma of the uterus; while Virchow, Rokitansky, and Schröder, recognise that fibromyomata may undergo sarcomatous degeneration. (See Fibromyomata.) There is abundant evidence, however, that sarcomata, originating in the parenchyma and abounding in round and spindle celled elements, may possess sufficient fibrous stroma to give them a consistence by which they may be mistaken for fibromata. The so-called "recurrent fibroids" belong to this class. Some of them grow to enormous size. A case reported by Ott (*Annales de gynécologie et d'obstétrique*) which had been operated upon by Lebedeff, three years previously, and was followed by apparent cure, developed a retroperitoneal tumour which lifted the uterus nearly to the umbilicus. Reed operated upon a similar case (Fig. 186) in the Cincinnati Hospital (1900); the tumour, which was distinctly sarcomatous, was retroperitoneal, occupied the whole pelvis, and lifted the uterus quite to the umbilicus. After the removal of the tumour with the uterus, the latter seemed relatively small as it was seen perched upon the mass (Fig. 187).

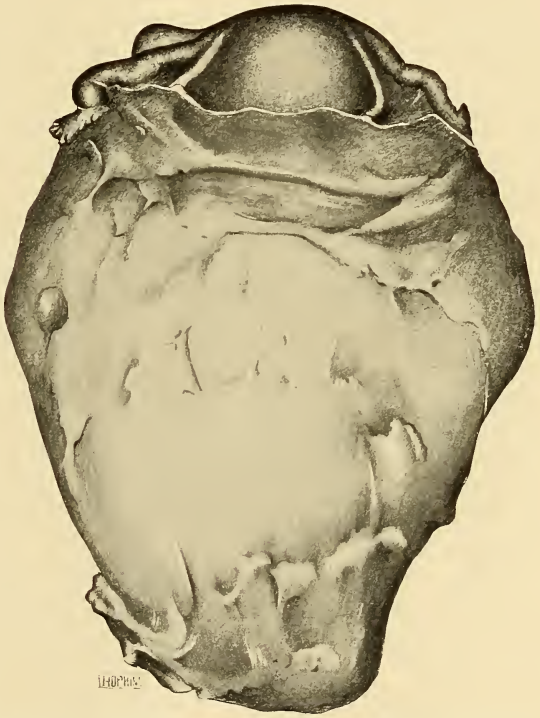

Fig. 187.—"After the removal of the tumour with the uterus, the latter seemed relatively small as it was seen perched upon the mass."—Reed.

The *symptoms* of sarcoma of the uterus are hemorrhage, offensive discharge, and pain, differing in no essential particular from the symptoms of carcinoma. Pain does not occur as a rule in the earlier

stages of the disease, but is very constant in the later stages. The uterus is generally enlarged and if kept under observation will be found to increase more rapidly than in true carcinoma. If the cervix is dilated to a degree sufficient to permit of digitation of the cavity, the neoplasm, if originating from the connective tissue of the endometrium, and if of the distinctly round-celled variety, will be soft and friable. In the majority of cases, it will be impossible to distinguish sarcoma from carcinoma, without a microscopic examination. The more solid sarcomata of parenchymatous origin have about the same morphology as fibroids, from which they are distinguishable, as a rule, only by their more rapid growth; and even this point may be misleading when a tumour of the strictly myomatous type, in consequence of pressure, becomes suddenly œdematous. In view of the fact that rapidly-growing solid tumours of the uterus are sometimes distinctly sarcomatous from the start, and, in view of the fact that those which are myomatous in the beginning may undergo sarcomatous degeneration, it is safer to look upon all of them as essentially malignant.

The *causes of sarcoma* of the uterus are not determined. The fact that it is a disease of the extremes of life, and especially of old age, would indicate that age is a possible factor. It is difficult to reconcile the evidence on this point. Thus Roger Williams finds that instances have been reported by Farnsworth at thirteen months, by Pick at two years, by Ahlfeld at three years and four months; and at various ages by Hereford, Clay, and Pick. Of 73 cases, by Gusserow, 4 began under the age of twenty-nine; 5 began from twenty to thirty; 15 began from thirty to forty; 28 began from forty to fifty; 18 began from fifty to sixty; 3 began above sixty. Pregnancy and the marital relation do not seem to exercise much influence. Of Gusserow's 73 cases, 35 were parous women, who, between them, had borne fifty-one children; 25 of his cases were absolutely sterile, 4 of them being virgins. There is no evidence that even in parous women the traumatism of parturition bears any relation to this disease.

The *treatment of sarcoma*, like that of other malignant diseases of the uterus, must consist of such means as will secure its complete eradication. This can be accomplished only by the extirpation of the uterus. (See Vaginal Hysterectomy.) The disease is one of the most malignant and should, therefore, be attacked as soon as detected. An attempt has been made to treat sarcoma of the uterus, as of the more superficial structures, with the toxines of erysipelas and the *Bacillus prodigiosus*. Coley, who is largely responsible for the introduction of the treatment, calls attention to the fact that collapse is liable to occur from too large a dose, especially when injected into a very vascular tumour, and that pyæmia has resulted from the use of the serum. The toxines, to be of value, must be prepared from highly virulent cultures of the streptococcus of erysipelas. They seem to act upon sarcoma by inducing a rapidly progressing necrobiosis with fatty degeneration, to secure which the toxines are to be injected directly into the tumour.

This treatment should never be employed in a case amenable to operation, while in one not amenable, any treatment which seems to rest upon a logical basis is justifiable. Franqué reports that in 16 cases of sarcoma occurring at the Würzburg clinic, 1 case remained cured for five years after three operations. Another case was free from recurrence after two years and 4 remained well for one year. Two died on the table after operation. These results are more satisfactory than those reported by Rogivue, in 50 cases treated by hysterectomy. Of these but 3 remained cured, 32 were known to have had a return of the disease, 2 of them within a year after the operation.

Carcinoma uteri is a malignant growth, consisting of epithelial cells embedded in a stroma of embryonal character, and of either congenital or post-natal origin. It is an affection which was known to Hippocrates and other ancient medical writers. The uterus is probably the most common seat of carcinoma in the human body, although older statistics give the stomach the first place. However, when these statistics were compiled, some affections of the uterus really carcinomatous in nature, such as the so-called papillomata and cauliflower excrescences, were not counted in their proper places. According to the statistics of the Registrar General, there died in England from cancer between 1847 and 1861, 87,348 persons. Of these, 25,633 were males and 61,715 females. About 25,000 of the latter succumbed to cancer of the uterus. It is now asserted that carcinoma in general, and carcinoma of the uterus in particular, is frightfully on the increase. Park has recently attempted to show the correctness of this assertion so far as one section of our country is concerned. Dührssen (Die Verhuetung des Gebärmutterkrebses, *Medicinische Woche*, 1899), in commenting upon the horrible increase of cancer of the uterus, states that 25,000 die annually in the German Empire from carcinoma uteri, or three times as many as die in childbed from all causes. This author thinks that only from 10 to 30 per cent of all cases in Germany are still amenable to operation when a definite diagnosis is first made, because it is, as a rule, made too late. He therefore recommends that women be made acquainted, through popular writings of medical men, with the dangers of carcinoma of the womb; further, that every means should be tried in every single case to arrive at a correct diagnosis early. After this is made, everything possible should be done to induce the patient to submit to an immediate operation. Winter (*Lehrbuch der Gynäkologischen Diagnostik*, Leipzig, 1897, p. 216) upon this subject says: "The diagnosis of carcinoma of the uterus is the most responsible the physician is called upon to make. The price for every failure of diagnosis, or for a diagnosis made so late that the cancer has already become unsuited for operation, is a human life. Under all circumstances, and with all means at our disposal, we must strive to diagnose cancer at the very first examination. To wait in a suspicious case until destructive properties become manifest, as was so frequently done formerly, is to-day a most serious mistake."

The above quotations are here cited to impress the student and practitioner with the importance of the earliest possible diagnosis of carcinoma of the uterus, in which alone lies the only possible salvation. After the very earliest stages, cases have, as a rule, become unsuited to operation and are beyond human aid.

Cancer of the womb is rare before the age of thirty, more common between the fortieth and sixtieth years. It drops again after sixty years, but not so much on account of its real infrequency at that period, as on account of the smaller number of females alive after that age. Married life and childbirth have an obvious influence upon the liability to carcinoma. An hereditary predisposition is likewise manifest.

Pathology.—Carcinoma of the uterus may take its origin from the portio vaginalis, the cervix proper, or the body of the uterus. *Carcinoma of the portio vaginalis* is variable in its macroscopic characters, and a good deal in this respect depends upon the rapidity and the intensity of secondary, retrograde, destructive processes. The cauliflower excrescences, or polypoid carcinomata of the portio, arise from the lips, and form either broad bases or somewhat constricted pedunculated tumour masses, varying in size from a hazelnut to an apple. The surface of these neoplasms is never smooth, but uneven with crevices and clefts. It may be pale and whitish or of a pinkish tint, but the colour of the tumour itself is generally hidden from view by a dirty, seropurulent, bloody, greenish or yellowish, secretion. In another form of carcinoma of this part of the uterus, we find a diffuse infiltration and hardening of the portio. In early stages, ulcerations may be entirely absent and the surface may be smooth. When this form begins to ulcerate there may be present shallow ulcers only, while in the forms first described, the ulcerations usually lead to great destruction of the tissue and form craterlike cavities. In spreading, carcinoma of the portio vaginalis generally first reaches and then infiltrates the vaginal walls. Early spreading into the cervical mucous membrane is rare. Involvement of the corpus uteri in primary carcinoma of the portio is quite rare. In their further growth these cancers infiltrate the lateral parametrium. The bladder is, as a rule, reached only late, and then from the anterior vault of the vagina. Involvement of the rectum is rare. The lymphatics involved are those following the course of the iliac vessels.

Carcinoma of the cervix takes its origin from the surface or from the glandular epithelium of this part. It usually begins as a circumscribed nodule or as a diffuse infiltration, involving either part or the whole of the circumference of the cervix. A very marked infiltration formed in this manner may then ulcerate and lead to extensive loss of substance and excavation. Or, there may be from the start a slight degree of infiltration only, with early shallow ulcerations and destruction of the superficial layers. Spreading goes on from the cervix in the direction of the body. It may have the form of a superficial ulceration along the corporeal mucous membrane, or it may be a diffuse or circumscribed lymphatic infiltration into the uterine wall.

Spreading over the vaginal mucous membrane rarely, if ever, occurs, but later on, an infiltration of the deeper layers of the vaginal walls is common. The pelvic connective tissue is generally invaded from the deepest part of the growth. The bladder is often involved early, the rectum, as a rule, late. Lymph-gland involvement is similar to that in carcinoma of the portio.

Carcinoma of the body of the uterus starts from the corporeal mucous membrane. In the diffuse form the whole mucous membrane is more or less involved and, in places, infiltrated with thicker roundish or irregular nodules. The further development of the new growth enlarges the corpus uteri in all its dimensions and the cavity becomes markedly enlarged so soon as ulcerative processes and sloughing set in. Sometimes there may be only a circumscribed limited carcinomatous process, while the major part of the mucous membrane is not involved. The polypoid form of carcinoma of the body is rare. When carcinoma of the corpus in its extension reaches the outer zone of the body, adhesions to surrounding parts become frequent, particularly to the intestines, which may become perforated by carcinomatous growth. Involvement of the bladder and the rectum occurs late, as a rule. The lymph glands generally first involved are the lumbar glands in the neighbourhood of the aorta. There may be in all forms of carcinoma of any part of the uterus, an unusual involvement of lymph glands in consequence of reversed metastatic transport.

Histology.—Carcinoma of the uterus is a malignant atypical neoplasm arising from epithelial structures and showing, as a rule, the well-marked alveolar arrangement so characteristic of cancer. Since we find two different kinds of epithelia in the uterus we also find carcinomata differing in the types of their cells. The cancers springing from the portio are almost invariably squamous-celled carcinomata. The epithelia lining the portio proliferate rapidly, and infiltrate the underlying connective tissue in the form of pegs or columns or pillars of cells. These cells in proliferating vary a good deal in shape, and deviate from the type from which they originally sprang. In the cervix where we normally have no squamous, but only cylindrical cells, we likewise find besides columnar-celled cancers, squamous epithelial carcinomata. This is probably not so much due as some believe to a preceding or coinciding metaplasia of the epithelia, as to a preceding substitution by which the columnar epithelium has been replaced by that of a squamous type (Fig. 188). Carcinoma of the corpus consists, as a rule, of epithelia of the columnar type. But it must be kept in mind, that as soon as we have a well-developed alveolar arrangement in the neoplasm, the epithelia have become so atypical in shape and size that one can speak with propriety, neither of columnar nor of squamous cells; the latter under these considerations also lose their prickles.

It is very difficult to distinguish between glandular hypertrophy and beginning carcinoma. Recourse must be had to atypical mitotic

figures which always speak strongly for tumour formation. These features have been more fully mentioned above under the head of Sarcoma Uteri. Amann (*Mikroskopische Gynäkologische Diagnose*, Wiesbaden, 1897) attaches a good deal of significance to the direction of the polar spindle with reference to the surface on which the epithelia are situated, in the matter of diagnosis between simple hypertrophy or malignant neoplasm. It is impossible here to go into the finer details of the microscopic diagnosis of carcinoma. In a well-developed case, when it is, however, usually too late to operate, the histologic picture is so typical that even a tyro can make a microscopic diagnosis. While, on the other hand, in the very beginning, when there is still time for a hopeful operation, it often requires delicate fixation, exact orientation, and general careful preparation of the microscopical material, to enable even the expert to arrive at a definite conclusion. In trying to get at the latter it is perhaps better, as stated by Herzog in a paper on The Microscopic Diagnosis of Uterine Scrapings, to err on the side of too great a readiness to see atypical and malignant features, instead of being too ready and prone to overlook the former and to see only hyperplastic processes; particularly, since the suspected cases, as a rule, with few exceptions, occur in women at a period when the uterus has accomplished its object as a fruit bearer, and when its removal is not objectionable from physiological and social reasons.

Fig. 188.—"The columnar epithelium has been replaced by that of a squamous type."—Herzog (page 439).

The *causes* of carcinoma of the uterus are by no means determined. The disease is liable to occur at any age. Pozzi mentions a case by Ganghoffer, of a child nine years old, who died from medullary carcinoma. Gusserow accumulated the records of 3,385 cases showing the age at which carcinomatous diseases began, as follows:

17 years.....	1 case (Glatter).	40 to 50 years.....	1,196 cases.
19 years.....	1 " (Beigel).	50 to 60 years.....	856 "
20 to 30 years...	114 cases.	60 to 70 years.....	340 "
30 to 40 years...	770 "	Above 70 years.....	193 "

Pozzi maintains that poverty is a predisposing cause of carcinoma, and supports his contention by the statistics of Schröder, showing that the disease is 1.5 per cent more frequent in the charity wards of the

hospitals than in private practice. These statistics are sustained by the observations of A. Martin. Dührssen, on the other hand, quotes Roger Williams approvingly to the effect that uterine cancer is not, as was believed, more frequent in the lower classes, but that predisposition to this disease is given by the over-feeding and comfortable position of those in better circumstances. Dührssen further asserts that more women die annually in Germany from carcinoma than there were soldiers killed in the entire Franco-Prussian War, the mortality ranging from 0.5 to 1.0 per thousand; and that all classes alike are susceptible to the disease. The traumatisms of parturition have been looked upon as causes of carcinoma of the uterus; while the frequent observation of commencing cancer at the site of an old laceration, and the well-known tendency of cicatricial tissue to undergo malignant degeneration, have been quoted in support of the theory. Statistical tables bearing upon this point are valueless, in view of the fact that the majority of women are married and have children, and of the additional fact that individual cases are constantly occurring in unmarried and continent women.

The question of the parasitic origin of carcinoma of the uterus involves the question of the germ origin of carcinomata in general. Edmund Andrews has conducted a series of investigations touching this point from which he concludes that, other things being equal, primary carcinoma is most frequent on those surfaces which, by their position, would be most accessible to free swimming microbes or spores derived from without the body; that the liability to cancer is increased if the epithelial surface is so situated that the spores can remain upon it for at least some hours without being washed away; and that the liability to cancer is great if the membrane has vast numbers of deep glandular follicles into which the spores can penetrate, and lie free from disturbance, and gain direct access to the more delicate epithelial cells. He has made an interesting computation showing the liability of different surfaces to carcinoma in proportion to their exposure to germs and their ability to afford to them an undisturbed lodging, by which he arrives at the conclusion that the cervix uteri is 5,776 times more liable to cancerous disease, than is a similar area of intestine, which he computes at unity and uses as a standard for comparison. It is interesting to note that the vagina is as 61 to 1 and the vulva as 264 to 1 in the same scale. A number of culture and inoculation experiments have been made with reference to demonstrating the bacterial origin of carcinoma. Francke (*Münchener medicinische Wochenschrift*) believed that he had confirmed the alleged discovery by Scheurlen of a bacillus of carcinoma. This bacillus was described as being 2 micromillimetres long and 0.4 micromillimetres broad, and as producing in culture media a reddish-brown pigment. Subsequent investigation, however, failed to substantiate the claims of this bacillus to recognition as the essential organism of carcinoma. While this organism has not been isolated, evidence points in the direction of a bacterial origin of

this disease. Hanan (*Fortschritte der Medizin*) transferred small portions of the secondary growth in the inguinal and axillary glands of a white rat, dead from carcinoma of the vulva, to the abdominal cavities of two other rats; one of these animals died at the end of two months, and there were found in its omentum fully developed nodules rich in the cellular elements of carcinoma; while in the other animal there were evidences of a successful vaccination of carcinoma. The repetition of these and similar experiments, especially by Italian investigators, has confirmed the inoculability of carcinoma, although the precise element upon which this inoculability depends has not yet been determined. The most that can be concluded at present is, that the evidence points in the direction of the bacterial origin of carcinoma. The investigations now in progress under the supervision of Roswell Park bid fair to result in more definite conclusions.

The *symptoms* of carcinoma of the uterus are uncertain and indefinite in the earlier stages, the disease in the majority of instances being exceedingly insidious in its onset. Pain is rarely present until after the disease has made considerable progress. When it is located in the cervix, the first symptom to arrest the attention of the patient will be a persistent watery discharge slightly tinged with blood; this may or may not be associated with fœtor. A little later, the discharge becomes distinctly sanguineous, and, as the disease progresses, irregular and violent hemorrhages occur. The uterus by this time generally becomes more or less painful—particularly if the endometrium is involved, or if there is an upward extension of the disease from the cervix. The occurrence of hemorrhage at the menopause, or following it, should be regarded with suspicion, and should always be the occasion for a careful local exploration. The *diagnosis* is generally obvious in cases of carcinoma involving the cervix. The finger will at once detect an enlargement of that segment of the womb; if in the earlier stages, the tissues will seem nodular and indurated; if in the later stages, after disintegration sets in, the surface will be irregularly granular and friable, bleeding upon the slightest touch. At this stage, to the experienced surgeon, the odour of the discharges is so characteristic that a diagnosis is made, as a rule, before the examination is begun. In cases of carcinoma involving the corpus uteri, diagnosis will be based, first, upon their rarity, and, next, upon the microscopic examination of some of the tissue removed. In all cases of suspected cancer of the uterus, when the disease is not so advanced that the diagnosis practically declares itself, a microscopic examination should be made of a piece of tissue removed from the diseased area. This is especially true when the disease is in its incipiency, manifesting itself by either an indurated nodule or a circumscribed erosion of the cervix. It is not important, from a practical point of view, to distinguish between carcinoma and sarcoma of the uterus, as the treatment is precisely the same in either case. As a matter of scientific interest, however, the investigations of Adamkiewicz (*Centralblatt für die medicinischen Wissenschaften*, Berlin)

are worthy of attention. He has endeavoured to establish distinctions between carcinoma and sarcoma by inoculation experiments. If fresh carcinoma tissue is implanted in the brain of an animal—preferably a rabbit—the animal will die in the course of two or three days, with severe lesions only to be explained by migration of the elements of the implanted carcinoma tissue into the interstices of the brain substance, and subsequent production of patches of inflammation and necrosis. Carcinoma tissue also responds with a typical reaction to "cancroin," the trimethylvinylammoniumoxydhydrate base of neurine, the specific poison which kills the carcinoma coccidium. Adamkiewicz therefore suggests as an infallible means of distinguishing carcinoma to implant a scrap of the suspected tissue in a rabbit's brain. If it is not carcinoma, the tissue will be absorbed and the animal will remain in its usual health. This and the absence of the cancroin reaction indicate a non-carcinomatous character for the neoplasm.

There are many *complications* of cancer of the uterus. Carcinoma may occur in a myomatous uterus; while myomata themselves are liable to undergo malignant degeneration—especially of the sarcomatous type. The coexistence of various benign and malignant neoplasms in the same uterus, while not frequent, is occasionally encountered. The coexistence of sarcoma, carcinoma, myoma, and polypus, is reported by Neibergal (*Archiv für Gynäkologie*, 1896) (Fig. 189). In cases in which carcinoma or other malignant neoplasms have begun to disintegrate, mixed infections of the endometrium speedily ensue.

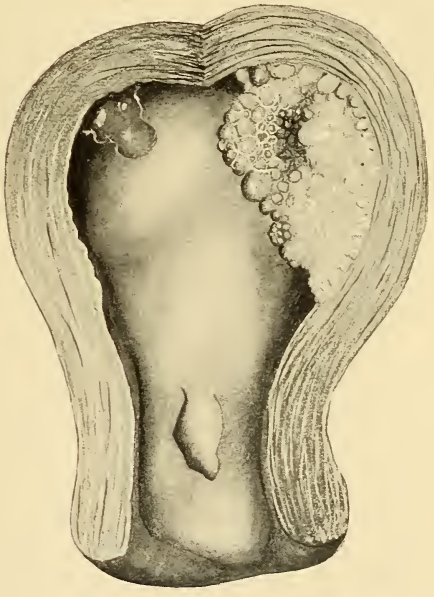

Fig. 189.—"The coexistence of sarcoma, carcinoma, myoma, and polypus is reported by Neibergal."—Reed.

Pregnancy as a complication of carcinoma of the uterus is occasionally encountered. It is always a serious complication, and one that is a menace alike to the life of the fœtus and of the mother. An interesting series of one hundred and sixty-six cases of cancer of the uterus, occurring between 1886 and 1895, has been compiled by George H. Noble, of Atlanta, Ga. The complication is one which precludes the possibility of normal delivery, even should pregnancy go to term, while abortion is likely to prove fatal. Reed has reported (*Transactions of*

the Ohio State Medical Society) a case in which amputation of the cervix for carcinoma had been done by another operator in the presence of unsuspected pregnancy, and in which the patient was permitted to go to term; when labour began, the cervix was found to be distinctly carcinomatous—a condition which, in the absence of necessary surgical aid, speedily resulted in the death of both mother and child. When the cancerous uterus is found to be impregnated, vaginal hysterectomy should be done in the earlier stages of the pregnancy; or, if the woman is permitted to go to term, she should be delivered by Cæsarean section or the Porro operation. Vaginal hysterectomy should be employed so long as there is a reasonable opportunity of delivering the diseased and impregnated organ by that route; the Porro operation (abdominal hysterectomy) should be done in the later stages of pregnancy, when there is a prospect of removing all of the malignant structures; the conservative Cæsarean operation, according to Noble, "ought to be employed in all cases with obstruction to the birth of the child by extensive exudate, or where there is not a reasonable hope of eradicating malignancy." The question of operative interference after the period of viability has been reached, is one which can not be settled by any definite criteria. The condition ought to be explained to the family and especially to the patient, who should be given an opportunity to choose between the desperate alternatives. The fact should be remembered, that a carcinomatous uterus may be able to carry a pregnancy to term, and that a living child may be born by either the Cæsarean or the Porro operations. At the same time, it should be clearly held in mind that, in consequence of a pregnancy, a carcinomatous uterus may be suddenly provoked to violent and fatal hemorrhage. The time for operation, and the character of the operation, should be determined by the surgeon and the patient in full recognition of these facts.

The *prognosis* of carcinoma if left to itself is that of inevitable fatality. The average duration of life when the disease follows a natural course is from twelve to eighteen months. In cases in which disease is too advanced for radical operation, the conservative treatment by curettement stops hemorrhage and waste, and prolongs life, but, of course, only defers for a time the inevitable termination.

Treatment: Palliative.—*Topical Medication.*—A quarter of a century ago, when the microscope was not in extensive use, cases of ulceration of the cervix, one centimetre or more in diameter, were encountered, which were looked upon as ulcers, chancres, or beginning cancers. It was the custom to treat such cases with lunar caustic, nitric acid, etc., making an application once in four or five days. Carstens has observed cases in which this treatment has been followed by perfect healing, though the disease was certainly not syphilitic. Hence the condition must have been benign or the beginning of a malignant growth. On the contrary, in some cases thus treated the patients were apparently cured but died a year or

two later of cancer. It may be possible that those patients that recovered permanently had a nonmalignant ulcer; while those who developed cancer in a year or two had ulcers that were cancerous in the first place, but, by the application of caustic, the removal of the neoplastic formation, and the stimulation of healthy granulation, the parts healed, although in the deeper structures cancer cells remained, which continued to develop and involve the whole womb and the surrounding structures. In more advanced cases the cervix was removed and then cauterized with chromic acid, pure bromine, mercuric nitrate, zinc chloride, etc. The various pastes and plasters used even to-day by quacks who call themselves cancer doctors, have long been discarded. The basis of all these plasters and pastes has been either arsenic, lime, or zinc. Any of these preparations placed in quantity on soft tissues will destroy them in various directions and in a most irregular manner that can not be controlled.

It was left to J. Marion Sims to put the nonsurgical treatment on a scientific basis, and his method has been followed with very slight modifications ever since by gynecologists. To-day, with all our surgical experience, we meet with many lamentable cases which are beyond our surgical skill. All we can do is to relieve symptoms, stop the hemorrhages, prevent the drain on the system, ease the pain, and prolong life. When the uterus is fixed or the broad ligament involved, perhaps even the base of the bladder or the vagina, a vaginal hysterectomy is of no use. In such cases Carstens proceeds as follows: All diseased tissues are thoroughly removed with the knife, scissors, or sharp curette, going over the ground repeatedly, so that the apparently healthy tissues are reached. When working at the base of the bladder or rectum, great caution must be exercised to prevent perforation. The hemorrhage may be extensive at first, but as more healthy tissues are reached, the hemorrhage ceases unless the circular or uterine arteries, which may require the application of a ligature or the forceps, are opened.

Sims's method was to apply iron perchloride to this large raw surface to stop the hemorrhage, removing it in twenty-four hours, and then applying caustic; but, as caustic is the best hemostatic, Carstens always applies it at once as follows: A piece of absorbent cotton, of a size and shape to suit the cavity and made round or long according to indications, is attached to a string. This is dipped in a solution of zinc chloride, one ounce, to half an ounce of water. It is then squeezed as dry as possible, care being taken to dry the fingers immediately, to prevent damage to them, or, still better, to conduct the whole operation with rubber gloves. Having again dried the cavity, the cotton is carefully placed so that it comes thoroughly in contact with all the raw surface. If it is not dry enough, it will run down the vagina and cause trouble there. To prevent this accident, Sims suggested filling the vagina with absorbent cotton and saturating it with sodium bicarbonate which would immediately neutralize the zinc;

but this method is improved upon by Carstens, who takes a ball of dry absorbent cotton large enough to fill the vagina, and to which also a string is attached, and packs it into the vagina. The upper part catches any little discharge of the chloride of zinc, minimizing its caustic action and limiting it to the upper part of the vagina. In the string attached to the cotton containing the chloride of zinc, one knot is tied. In that attached to the dry cotton two knots are tied, in order to distinguish them and to indicate in which order to remove them. This packing is allowed to remain for forty-eight hours, when it is removed and vaginal douches used. The slough that is formed by the caustic comes away in about ten days, often in one large piece, leaving beneath it a clean granulating surface, which rapidly contracts, and frequently entirely closes, except the small fistulous opening through which menstruation can take place. It is astonishing how quickly women will recover and gain strength after this procedure; the discharge ceases, the appetite improves, and the patient gains in weight twenty or thirty pounds in three months. In the course of time, however, recurrence takes place, sometimes within six months, sometimes not for a year or more. If the case is carefully watched, the foregoing procedure can be repeated at once on recurrence, and, if taken very early, the small point where recurrence takes place can be easily curetted and cauterized without the use of an anæsthetic. Secondary deposits in the pelvic lymphatics or those of the intestines or stomach are, of course, beyond reach.

Bromine is so volatile and difficult to handle that it affords no advantages whatever, and Carstens has entirely discarded it. *Formalin* has been recommended. *Calcium carbide* was recommended by the late J. H. Etheridge, of Chicago, but its use in the hands of others yields no more benefit than, if as much as, is derived from the zinc chloride. The technique of the use of these various caustics is the same as that previously given for the zinc chloride. It seems that the latter remedy is the best that can be used in such lamentable cases.

The treatment of malignant growths by *serum* is still in its infancy. The consensus of the profession seems to be, that in cancer it is of no benefit, but that in cases of sarcoma, a limited number seem to be benefited. Carstens has tried it in quite a number of cases with absolutely no benefit, and it has been used in the hospital under his observation in many cases, for malignant growths of different kinds and situated in different parts of the body, without benefit. It has seemed to him that in some cases there is a spontaneous cure of sarcoma. He is sure that he has seen a number of cases in which a disease that had been pronounced sarcoma by various physicians, has entirely disappeared. But our knowledge is still so limited that little hope of benefit from serum therapy can be entertained. If the future discovers the microbe of cancer, as may be hoped, we may hope also that an antitoxine will be produced which will check the ravages of this terrible disease.

Curettement, considered as a palliative measure in advanced cases, is an expedient in favour with many operators. With the patient under an anæsthetic, the diseased parts may be scraped thoroughly with a Récamier or other sharp curette, with the Simon scoop, or with the Thomas spoon-saw. The scraping should be followed by daily vaginal injections with antiseptic solutions. Carstens never practises this method, on the ground that, if he did, he might as well practise cauterization (see *ante*), which he insists will accomplish more good.

High amputation of the cervix is indicated in cases in which the disease has gone beyond the uterus, and where the discharge is so disagreeable, and the hemorrhage so extensive, as to make life a burden. With the brilliant results of to-day, achieved by the complete removal of the uterus, so-called "high amputation" is practised but rarely, and should never be employed when the organ is removable. The patient, under the influence of an anæsthetic, is placed on her back with her buttocks on the edge of the operating table. After the vagina has been thoroughly cleansed, a retractor is inserted. The diseased parts are grasped with volsella forceps and the cauliflower growth removed with scissors, after which the vagina is again cleansed. Then, with a two- or three-pronged volsella forceps, the cervix is seized more firmly, an incision is made all round the uterus at the junction of the mucous membrane of the vagina and of the cervix; the vaginal mucous membrane is next pushed back with the fingers, or with a blunt dissector, for a quarter of an inch or so, and a conical piece removed from the uterus. The apex of this cone corresponds to the uterine canal. The hemorrhage is quite profuse when the circular artery is cut, and will require ligation of the vessel. Sometimes a simple twisting of the artery will be sufficient, but this measure is not trustworthy. The cavity thus produced can be packed with antiseptic gauze, but it is better to treat it with zinc chloride as before mentioned.

The **radical treatment** of carcinoma of the uterus consists in the extirpation of the diseased organ, and of the neighbouring lymphatic glands when they are involved and removable. The operation has been extended in recent years to include the removal of lymphatic glands from the interior of the pelvis, and to the removal of a part or all of the vagina. The uterus may be removed by either the vaginal route (*vaginal hysterectomy*), or by abdominal section (*abdominovaginal panhysterectomy*).

Vaginal Hysterectomy.—The removal of the uterus by the vaginal route is not a new operation, having been performed in a limited number of cases early in the present century by several operators, among whom Osiander, von Langenbeck, and Sauter were prominent. But the technique then practised met with such indifferent success that the procedure was practically abandoned until the advent of antiseptic surgery and improved hemostasis. Its revival is due to the work of Czerny in 1878, since which time it has by many operators been given the preference in selected cases over the abdominal route.

Instruments for Vaginal Hysterectomy

Catheter, glass	1	Packer, vaginal (Fig. 193)	1
Curette, small (Sims's modified)	1	Retractors, large	1 pair.
Martin's	1	Next size smaller	1 "
Forceps, long dissecting (Fig. 190)	1	Small size	1 "
Short dissecting	2	Scalpels	2
Long hemostatic	6	Scissors, long	1 pair.
Medium hemostatic	6	Sharp-pointed	1 "
Small hemostatic	6	Speculum, Jones's	1
Bullet	2	Sims's medium	1
Needles, curved (Fig. 191), large	2	Simon's, with handles and four blades	1
Small	2	Sound, uterine	1
Medium	2	Sponge holders (Fig. 194)	4
Transfixion, right curved	1	Tenaculum, Cullen's (Fig. 195)	1
Straight	1	Straight	1
Needle holders (Fig. 192)	2	Blunt	1
Museux's volsella forceps	2	Round, sharp	1
Hysterectomy forceps, Péan's curved	2		
Péan's straight	2		

An angeiotribe or a Skene's electro-hemostatic forceps (see Hemostasis), with attachments, should be at hand provided the operator desires to avail himself of these means of hemostasis.

Technique of Vaginal Hysterectomy.—The procedure is as follows: The patient, prepared as is usual for vaginal and peritoneal section, is placed in the lithotomy position with the hips well over the edge of the table. The posterior vaginal wall is retracted by means of a Sims or Alvard, or preferably a Jones, self-retaining speculum, exposing the vaginal vault and cervix uteri. The anterior lip of the cervix is seized with the volsella forceps, and the uterus drawn down (Fig. 196), continuous irrigation with a solution of bichloride (1 to 4,000) being employed from this point until the peritoneal cavity is opened.

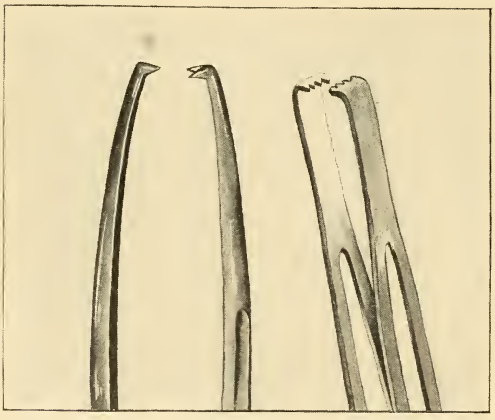

Fig. 190.—Dissecting forceps.—Robb.

In septic, and some cancerous cases, the cervical canal should be curetted and swabbed with a 95-per-cent solution of carbolic acid. When extensive sloughing of the cervix has occurred, it is best to curette and cauterize it during the preparatory treatment of the preceding week, to eliminate as much *débris* and septic material as possible from the field of operation. In all cases, curetting and cauteriza-

tion is followed by sewing together of the anterior and posterior lips of the os, effectually closing it against leakage from the affected organ. This is accomplished by three or four interrupted sutures of the strongest braided silk, the ends of which are left long for traction. A circular incision is made through the mucous membrane of the vagina, and carried round the entire cervix, keeping close to that organ except in carcinomatous cases where a margin of 2 centimetres (0.75 inch) should be allowed for possible cellular invasion. The electric cautery or the thermo-cautery is substituted for the knife or scissors by some operators in making this dissection, to obviate the use of catgut or silk ligatures not infrequently required on the vaginal arteries.

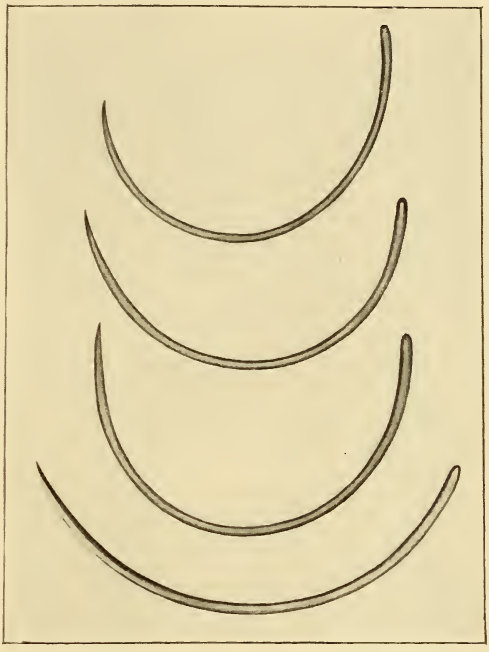

Fig. 191.—Curved needles.—Robb (page 448).

Newman uses the index and middle fingers to peel up the layer of connective tissue from in front of, and behind, the cervix until the peritoneum is reached. This can be recognised by the smooth gliding of its surfaces one upon another, and the small fluid accumulations in the cul-de-sac of Douglas. The irrigation of the vagina is now discontinued, and sponging with gauze substituted. The peritoneum is seized with tissue or artery forceps, nicked with the scissors, and the finger thrust through into the peritoneal cavity. The opening is extended with the fingers, as far as the broad ligament upon either side. The outer surfaces of the uterus, its adnexa and surrounding structures, are carefully examined, adhesions broken up, and a gauze sponge with tape attached, to which a catch forceps is applied, should be carried up into the peritoneal cavity to protect the parts from infectious material, and prevent the protrusion of omentum and intestine.

In the separation of the bladder from the anterior cervical attachments, great care should be exercised not to perforate or injure this organ or the ureters situated at the sides and front of the wound in its lower portion. Accident may be avoided by keeping the palmar surface of the dissecting fingers in close apposition to the uterine walls.

The vesico-uterine folds of the peritoneal membrane are opened close to their uterine attachment and the fingers inserted, enlarging the opening laterally, pushing the ureters carefully to either side, and completing the separation of the bladder. The uterus will now be found suspended in the pelvis by the broad and round ligaments alone. The clamping or ligating of this vascular area should be done with great care and precision, and, in each instance before the application of the clamp or ligature, its site should be drawn down and carefully inspected.

With the cervix drawn well to the left, and using lateral retractors to bring the structures well into view, the base of the right broad ligament is seized between the left thumb in front and index finger behind, and the uterine artery palpated. The portion of the ligament containing the artery is now included in the bite of a strong ligament

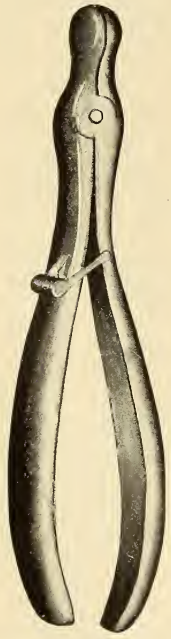

Fig. 192.—Needle holders.—Robb (page 448).

Fig. 193.—Packer.—Robb (page 448).

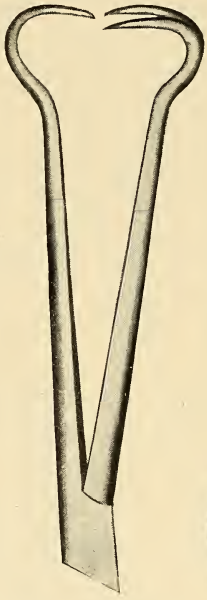

Fig. 195.—Cullen's tenaculum.—Robb (page 448).

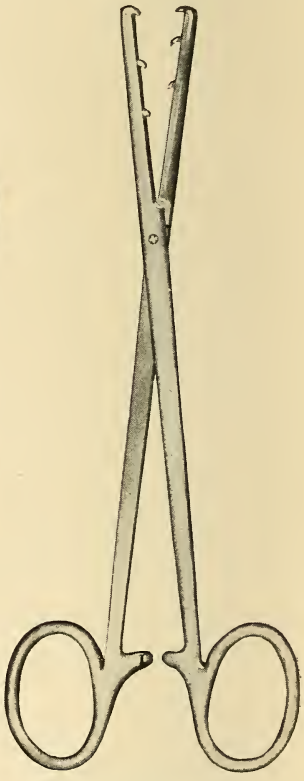

Fig. 194.—Sponge holders.—Robb (page 448).

forceps, or a strong silk ligature is applied about a centimetre distant from the uterus with a full curved aneurism needle (Fig. 197), and tied firmly.

The structures are now divided with scissors between the clamp or ligature and the uterus, close to that organ; and the base of the left broad ligament, with the uterine artery of that side, is treated in the same way.

Firm traction brings down the uterus for the placing of a second clamp or ligature immediately above the first on either side, and the tissues are incised in the same manner.

Using the finger as a guide, a large blunt hook or the finger is now passed over the top of the broad ligament, one side brought down sufficiently to permit the application of a third clamp or ligature, and the last incision is made, freeing the uterus entirely from its attachments upon that side. The fundus is drawn down outside the vulva, the clamp or ligature easily applied to the remaining portion of the broad ligament, and the uterus cut away.

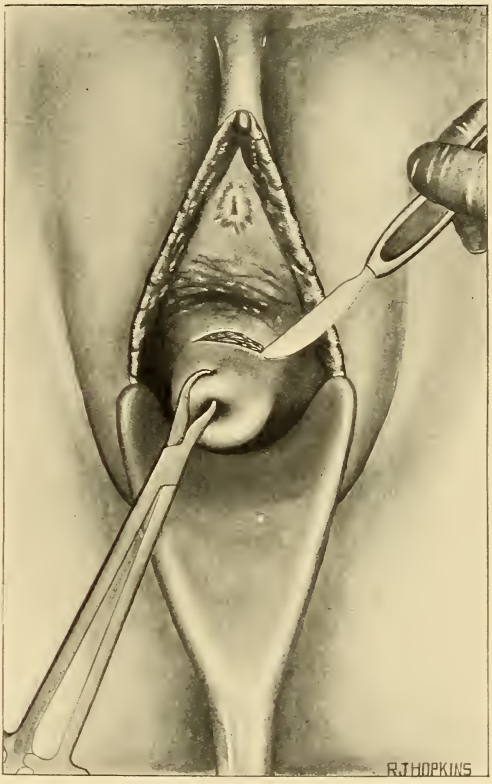

Fig. 196.—"The anterior lip of the cervix is seized with the volsella forceps and the uterus drawn down."—Newman (page 448).

Many operators vary this technique at the point where the uterine arteries have been secured by clamp or forceps, and the base of the broad ligament incised, by rotating the uterus forward through the anterior vesico-uterine incision, or backward through the posterior cul-de-sac. As a rule, this is easily accomplished by first pushing the cervix upward and forward, or backward, as the case may be, and then seizing the body of the uterus a little in advance of the cervix with a strong volsella forceps, and drawing it down either anteriorly or posteriorly, as desired. A second forceps then secures the tissues a little higher up, rotating or dragging the fundus still farther downward until it can be grasped and drawn out completely inverted.

The ligation or clamping of the ovarian arteries or the upper portion of the broad ligament, now proceeds from above downward, close to the uterus if the ovaries are to be saved, or beyond both tubes and ovaries along the tubo-infundibular ligament, if they are to be sacrificed.

Careful inspection should now be made of the stumps of the broad ligament, which are gently drawn down for the purpose. If there is

any bleeding, the insecure clamp or ligature should be readjusted. The vagina is sponged free of clots, and the sponge or sponges removed from the peritoneal cavity. A running catgut suture, which should include peritoneal and vaginal tissue, closes the vaginal vault, and secures the stumps of the broad ligaments in either angle of the wound.

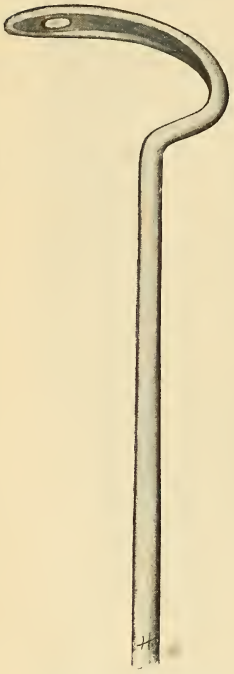

Fig. 197. — "A full curved aneurism needle." — Newman (page 450).

Full-width gauze, or narrower, with edges hemmed to prevent fraying, is used to pack the vaginal vault.

Where the forceps is used and suturing of the vault omitted, particular care should be taken to protect the ends of the clamps from projecting upward and coming in contact with the intestines. In this case the gauze packing not only protects the ends of the forceps and serves for drainage, but, being carefully placed above between the stumps of the broad ligament, prevents hernia or protrusion of the intestines. Gauze should also be so placed about the shanks of the forceps as to prevent danger of tissue necrosis of the vagina or vulva. The usual vulvar dressings are now applied, the handles of the forceps wrapped with gauze, and the patient put to bed. The urine should be drawn every six or eight hours, and the external genitals bathed each time with 1-to-4,000 bichloride. The forceps are removed in from 36 to 48 hours, but the gauze packing remains undisturbed for from 24 to 48 hours longer.

When the gauze is removed at the end of this time the patient should be in a good light and the packed area in full view, so that there may be no danger of disturbing the superimposed intestines.

A careful douching of the parts with sterilized water or boric-acid solution, may now be used twice daily, taking care not to carry the douche point too high up, or to allow too great force to the flow. The bowels should be moved by a laxative pill or mild salines followed by an enema the second day, and each day thereafter. No straining at stool should be allowed. Liquid diet should be given for three or four days, followed by nourishing but easily digested soft foods, nutritious broths, soft-boiled eggs, custards, and the like.

When the ligatures have been used upon the broad ligaments and fail to come away within a reasonable time after the operation, in the second or third week they should be gently drawn upon daily, and if still resistant, Sims's speculum should be used, and the ligatures removed under ocular inspection by cutting the loop. In general, the patient may be allowed to sit up in bed at the beginning of the third week, and at its end may be up in an easy chair, and about the room in the fourth week of convalescence.

All cancer cases should be carefully examined from time to time for recurrence of the disease.

Among the later and more important modifications in the technique of vaginal hysterectomy, should be mentioned that of removing with the cancerous uterus the pelvic lymphatic glands, a procedure analogous to the operation upon the axillary glands in mammary carcinoma; the operation described and done by Sippel, who opened into the ischiorectal cavity by lateral incision between the anus and the tuber ischii, and removed the vagina and uterus unopened and in their normal connection, claiming as advantages a good view, the accessibility of field, and the possibility of avoiding any contact whatever with carcinoma, or the contents of the vagina; and the use of the angeiotribe, or pressure clamp, to replace both retention clamps and ligatures for hemostasis of the broad ligament in vaginal and abdominal hysterectomy.

Abdomino-vaginal panhysterectomy for malignant disease has been strongly advocated by some, where the uterus could not be pulled down on account of adhesions, and also for the purpose of more thoroughly removing diseased tissues and the lymphatic glands situated within the broad ligaments, near the crest of the ilium, or in the neighbourhood of the ureters. There are exceptional cases in which this operation is required. When vaginal hysterectomy by the clamp method was in its infancy and only one clamp was used on each broad ligament, the tissues would sometimes pull out and the hemorrhage could not be stopped, so that the abdomen had to be opened in order to control the bleeding. With the present technique, this seldom if ever occurs. When the disease is so far advanced that the uterus with the diseased tissues can not be removed *per vaginam,* surgical intervention is of no avail for ultimate cure, while the immediate mortality certainly must be great. When metastasis into the lymphatics has once taken place there is no guarantee that it can be overtaken. The experience of distinguished operators goes to show that secondary deposits are more liable to occur in the stomach, liver, or high up in the intestines, than anywhere else. Hence Carstens would not advocate abdominal section in malignant diseases except in cases of sarcoma where the uterus is very large and still movable. There are others, however, who assume that continued efforts should be made to eradicate, if possible, carcinomatous glands of the pelvis. Although the operation is one of extreme severity it has a certain justification in the otherwise hopeless character of the disease. It ought not to be undertaken without having been first explained to the patient, who ought to be frankly advised of the desperate alternatives. It is, to-day, an operation from which nothing can be promised—although something may be realized.

The extended operation for advanced carcinoma of the uterus involves the removal, not only of the diseased organ, but also of the infected lymphatics within the pelvis. The operation is graphically described (*American Gynecological and Obstetrical Journal,* 1898) by

Emil Reis. The patient is placed in a very steep Trendelenburg position (Fig. 198) and an incision is made from the pubis to the umbilicus. The intestines either sink or are placed back toward the diaphragm, after which the surgeon inspects and palpates the pelvic organs and the large blood vessels from the aorta to Poupart's ligament and to the uterine artery. If during this examination enlarged and immovable glands are found, it is advisable to cut the operation short and to do only such palliative work as will afford as little danger to the patient's life and as much protection against hemorrhage, discharge, and pain, as possible. If there is no such enlargement of the glands, the operation continues as follows: First, the right infundibulo-pelvic ligament is ligated close to the pelvic wall; a clamp covers the broad ligament between the ligature and the uterus, and the ligament is cut through between the ligature and the clamp. The peritoneum is now incised along the common iliac vessels, which are further exposed by blunt or sharp dissection. Pushing the peritoneum back toward the side, the ureter, which crosses the common iliac vessels on or near their bifurcation, is soon reached. The ureter is then laid bare from the brim of the pelvis down to its point of entrance into the bladder, with the aid of an incision through the peritoneum of the vesico-uterine pouch. As this is done under the constant guidance of the eye there is no danger of injuring the ureter. The blood vessels which are cut in this procedure are ligated or temporarily provided for with clamps. The uterine artery is plainly seen in this dissection at a point where it crosses the ureter, and can easily be ligated under the guidance of the eye at its starting-point from the hypogastric artery outside the ureter. After the ureter is thus laid bare and the uterine and ovarian vessels are secured, there is remarkably little hemorrhage from the procedure which follows and forms the most important new step in this operation—the removal of the lymphatics with the surrounding fat and connective tissue. This is done by dissection with either a blunt or a sharp instrument. The area which was cleaned out in this way extended in Reis's cases over a surface limited by the lateral edge of the external iliac vessels superiorly, the pelvic wall laterally, the bladder anteriorly, the pelvic floor inferiorly, and posteriorly by the meso-rectum which, however, was lifted up and freed from all accessible glands. Bleeding vessels are ligated, or the hemorrhage, when it comes

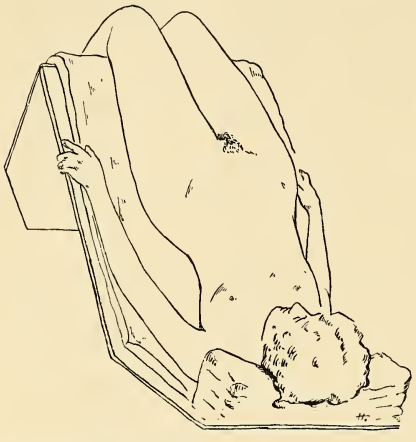

Fig. 198.—"The patient is placed in a very steep Trendelenburg position."—Reed.

from the side of the uterus, is checked by clamps, or simply by pulling hard on the uterus. Two edges of the peritoneum remain after the whole broad ligament and all the fat and connective tissue along the large vessels and the pelvic wall are removed. If adhesions exist between uterus and rectum, they are cut as close to the rectum as possible, because they sometimes form the path along which carcinoma spreads.

Then the procedure as done on the right side is repeated on the left, special attention being necessary here in order to empty the mesorectum as completely as possible without injuring too many of the hemorrhoidal vessels. The ureter and uterine artery are treated in the same way; the removal of fat and connective tissue with the lymphatics being carried to the same extent as on the other side. The peritoneum is left open for the time being, as on the other side, that the hemorrhage may be stopped by ligation of the blood vessels. Small arteries supplying the lymphatic glands sometimes give rise to some hemorrhage and must be secured by ligatures. The round ligaments are severed close to the anterior abdominal wall. The peritoneum of the cul-de-sac is now incised close to the rectum and the vagina is perforated at this point, either against the finger of an assistant, or against gauze introduced into the vagina. The vagina is severed after its walls have been secured by ligatures. The uterus is in this way freed all round and is removed. The wound can be closed toward the peritoneal cavity by suturing the peritoneal edges left in removing the broad ligaments and the uterus. This suture runs across the bottom of the pelvis in a transverse direction, uniting laterally the edges of the peritoneum of the vesico-uterine and recto-uterine pouches, and in the median line the peritoneum of the bladder and the rectum. Before this part of the operation, the space between the peritoneum and the cut edges of the vagina is filled with iodoform gauze if there is any oozing, or, if everything is perfectly dry, the cut edges of the vagina and the peritoneum can be closed in such way as to leave no dead spaces between them. The subsequent management of the case is the same as in abdomino-vaginal section for benign growths.

Werder, of Pittsburg, has extended the operation of abdominal hysterectomy for cancer by removing, in certain cases, all or a part of the vagina. The operation is done as in an ordinary hysterectomy, only after freeing the bladder the dissection is extended down along the vagina, separating its anterior wall from the bladder as far down as it is desirable to remove the vagina; the recto-vaginal space is then entered and the posterior wall is stripped off the rectum so far as is necessary, and, finally, the lateral attachments of the vagina are loosened. The uterus is now pushed down into the pelvic outlet, the vagina being inverted by making traction from below until it can be amputated above the prolapsed fundus. Werder claims for this operation that it affords the best opportunity for maintaining an aseptic field, since it can be done without touching the diseased cervix with the fingers. He has reported successful results from this method of operating.

Byrne's Operation of Electro-hysterectomy.—An operation that has occasioned much confusion in the surgical world is that devised by John Byrne, of Brooklyn, and designated by him "high amputation of the cervix." It consists in the removal of the whole uterus except a thin shell at the fundus (Fig. 199) and is, to all intents and purposes, a hysterectomy, the uterus being cut out by an electric knife, "followed by thorough dry roasting of the remaining excavation." To designate it as "high amputation of the cervix" and to attribute its results to "amputation of the cervix," is to impart the misleading idea that those results have been realized by the removal of merely the lower segment of the uterus. The title mistakenly given to this operation has itself, and without any reference to the scope of the procedure, prompted many not overstudious operators to attempt the cure of cancer of the cervix by simple amputation of the neck of the uterus. The result has been a tragic mortality, much of which might have been avoided; but which has, happily, resulted in the emphatic verdict of the profession that the surgical treatment of cancer of the uterus, to be successful, must involve the removal of the entire organ. Of the various operations for the removal of the uterus, none are more effective, and certainly none are followed by more satisfactory ultimate results, than the brilliant procedure of Bryne, as practised by himself, and described (*Electro-Hemostasis,* Skene, p. 71) as follows:

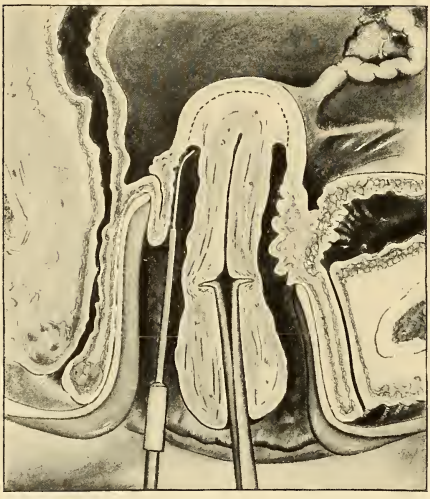

Fig. 199.—"It consists in the removal of the whole uterus except a thin shell at the fundus."—Reed.

"A diverging volsella, after being passed well into the cervical canal, should be expanded to a proper degree and locked, so as to afford complete control of the uterus during the entire operation. By alternate traction and upward pressure of the uterus, an accurate idea may be obtained as to the proper point to begin the circular incision, so as to avoid injuring the bladder or opening into the cul-de-sac of Douglas. As to the latter, however, should it be found that the disease has involved the retro-uterine tissues, and that its excision or destruction by the cautery can not be effected without opening into the peritoneal cavity, there need be no hesitation in doing so. I have never known any harm to come from it whether it was done accidentally or by design. Should it be evident at the outset that the operation, in order to be thorough, must include a portion of the cul-de-sac,

it will be better to make the line of incision anterior to this, until the cervix has been removed, and leave the incision of the retro-uterine parts by the cautery knife to be the final proceeding. Under these circumstances all that will be needed will be an antiseptic tampon properly applied. In proceeding to make the circular incision, the cautery knife, slightly curved *and cold*, should be applied close up to the vaginal junction, and from the moment the current is turned on, should be kept in contact with the parts being incised. Before removing the electrode for any purpose, such as change of position, or altering the curve of the knife, the current should first be stopped and the instrument again placed into position while cool before resuming the incision. In other words, if the knife, though heated only to a dull red, be applied to parts at all vascular, hemorrhage more or less will certainly follow; whereas, the cool platinum blade being already in contact with moisture as the current is being transformed into heat, vessels are shrunken or closed even before they are severed. This is a very important point and should never be lost sight of in all cautery operations. The circular incision having been made to the depth, say, of a quarter of an inch, it will now be observed that by increased traction the uterus may be drawn much farther downward, and by directing the knife upward and inward the amputation may be carried to any desired extent. In cases calling for amputation above the os internum, it will be better to excise and remove the cervix first; then, by dilating the upper canal sufficiently to admit the diverging volsella, once more proceed as in the first instance, taking care, however, to keep within bounds. It will be found that the cupped stump can now be drawn down and made to project as a more or less convex body. In all cases the dome-shaped electrode should be passed over the entire cavity repeatedly so as to render the cauterization still more complete. It is important to add that, in carrying the knife toward the sides of the cervix, circular and other arterial branches are likely to be encountered, and hence, in this locality particularly, a high degree of heat in the platinum blade is to be carefully avoided. As an additional security against hemorrhage, the convexity of the knife should be pressed against the external surface of each particular section cut, so as to close the vessels more effectually. It is well to state that the metallic parts of the electrode for the distance of about two inches should be covered with a strip of thin flannel, so that the vagina may be protected from injury through the reflected heat." (See Results of Operative Treatment of Carcinoma Uteri.)

Byrne claims for this operation that, by the action of heat on the surrounding structures, any possible remaining infection within them is destroyed, and that following the operation there is an absence of fever, and of almost all pain, either pelvic or peritoneal; that there is almost universal immunity of the scar tissue, after cauterization, from secondary attack in the event of the recurrence of the disease; and, finally, that in the event of relapse, the respite from reappearance of

disease in remote parts, even in the more unpromising cases of undoubted circumuterine infiltration, is longer than in other operations.

The **results of hysterectomy** for carcinoma should be considered as (*a*) immediate, (*b*) remote. The *immediate results* are concerned with the surgical recovery of the patient from the operation. The remote results take into consideration the permanency of the cure thereby secured. One of the most interesting of recent statistical researches relative to the immediate results of vaginal hysterectomy has been conducted by Ricard, of Paris (*La semaine gynécologique*, October 31, 1899), who places the primary mortality of vaginal hysterectomy at the hands of French surgeons at from 16 to 19.68 per cent. Monclaire and Picque place the mortality in France at 8.9 per cent, this computation being based upon 2,376 cases. Bigeard concludes, after a careful study of both the French and foreign statistics, that the primary mortality from this operation vacillates between 17 and 20 per cent. This is probably the representative figure. Hofmeier in 74 vaginal hysterectomies reported a mortality of 16.2 per cent. Munchmeier (*Frauenarzt*) reported 80 vaginal hysterectomies with 4 deaths. Byrne finds that in 1,273 colpohysterectomies by 38 European and American surgeons the average primary mortality is 14.6.

The figures relating to the *remote or ultimate results* of vaginal hysterectomy for cancer, are less satisfactory than those relating to primary results, for the sole reason that it is exceedingly difficult to keep track of the cases after they once pass from the surgeon's hands. The reports on this point from various operators are strangely conflicting. Thus, Bouilly states that all his cases operated upon since 1886 are dead; and Jacobs reports the same of his annual series of cases running back respectively three, four, five, and six years. On the other hand, Thorn, reviewing the statistics of the Magdeburg Clinic, concludes that half the cases in which the disease is limited to the uterus, operated upon in that institution, have a permanent recovery. Richelot has cases alive six, eight, nine, and twelve years, after operation. Freund reported nonrecurrence in a case eleven years after operation and Olshausen reported a case of immunity after twelve years. Reed has cases of nonrecurrence covering periods of respectively twelve, ten, nine, eight, seven, six, five years and less. McMurtry has a case of nonrecurrence after twelve years, and other American operators have cases of immunity after even longer periods.

The *extended operation for carcinoma* of the uterus has been followed by results which seem to justify its employment, particularly when it is remembered that without it the condition of these patients is absolutely hopeless. Reis has collected the tables of cases on page 459.

The primary results are not so satisfactory as in vaginal hysterectomy, but they may certainly be looked upon as justifiable when the otherwise hopeless character of the cases is taken into consideration. The adoption of this operation has been so recent that ultimate results are not yet determinable.

	Cases.	Recoveries.	Deaths.
Rumpf, Berlin (*Centralblatt für Gynäkologie*, Aug., 1895)	1	1	..
Clark, Baltimore (*Bulletin of the Johns Hopkins Hospital*, 1896)	8	7	1
Küstner, Breslau (*Peiser Zeitschrift für Geburtshülfe*, 1898)	2	2	..
Private communication from Boston	1	..	1
Emil Reis	3	2	1
Total	15	12 = 80 %	3 = 20 %

The *results of electro-hysterectomy* as practised by Byrne, can not be designated by any other term than brilliant. These results are summarized by Byrne himself in a paper before the American Gynecological Society, 1896, which begins with an allusion to a previous report to that body, and is as follows:

"I stated that in 40 out of 63 cases of cancer of the portio vaginalis (23 having strayed away) periods of exemption from relapse were obtained ranging from two to twenty-two years, being an average of over nine years for each; and of 50 out of 81 cases involving the entire cervix (31 being lost sight of), 10 had an exemption from recurrence for over two years, 11 over three years, 6 over four years, 8 over five years, 6 over seven years, 2 over eleven years, 1 over thirteen years, and 1 over seventeen years. Nor is this all, for the table would now bear important reconstruction—no less than 6 of these cases, and probably many more, having until now enjoyed a complete immunity. Moreover, one patient operated on in 1875, and a most unpromising case too, and who could not be found at the time of my report, has since been discovered by Dr. Homer L. Bartlet, of Flatbush, with whom I saw her, and who was present at the operation. Two months ago, or nearly twenty-one years after the operation, she was in perfect health."

CHAPTER XXX

CÆSAREAN SECTION AND ITS MODIFICATIONS

Definition and historical *résumé*—Indications—Preparations—Instruments—Position of child and placenta—The operation—After-treatment—Sänger's method—Porro's modification.

Cæsarean section is an operation whereby an opening is made in the abdominal wall, and another in the uterus, through which the fœtus is extracted.

According to Pliny, it is named Cæsarean because the first of the Cæsars was so extracted from his mother's womb as she was dying. According to another version it is named from the operation itself, "cæso matris utero."

This operation was at first done upon dead women at a more or less advanced stage of pregnancy. It is attributed to Numa Pompilius, one of the first Kings of Rome, who enacted (*lex regia*) that a pregnant woman, deceased, must not be interred until the fœtus was extracted. This law remained in operation throughout all countries under Roman rule, and was approved by the Church, as well as adopted as a civil law by the Northern states of Europe, more especially Germany. For many years they dared not perform the operation upon a living woman, and in this way encouraged the performance of craniotomy, as the passage of the fœtus through the pelvis in cases of deformity was impossible without mutilation.

Levret and Mauriceau deny that this operation was known to the ancients, but Dionis and Gardien refer to Pliny's *Natural History*. Mansfield published a work *On the Antiquity of Gastrotomy and Hysterotomy on the Living*. (Ueber das Alter des Bauch und Gebärmutterschnitts an Lebenden. Braunschweig, 1824.) He states that even in an earlier work than Pliny's, named *Mischnajoth*, written about 140 B. C., there is this passage: "In a twin birth, neither the first child which by section of the belly is brought into the world, nor the one coming after, can attain the rights of heirship or priestly office."

Nicolai Falconiis recorded a case at Venice in 1491. The case of Jacob Niefer, the Swiss peasant who performed it upon his own wife, is frequently quoted, but most authorities are agreed that it was much later before it was generally attempted upon the living woman. In fact, we need only refer to the action of Mauriceau in the case treated

by himself and Chamberlin, where the operation was delayed until after death, although Mauriceau was in actual attendance for several days. He wrote: "The child had been dead to all appearance about four days, and I told all the assistants that she could not be delivered. They asked me to perform Cæsarean section, which I did not wish to do, knowing that it was always certain death to the mother." This poor woman died with her infant *in utero*, twenty-four hours afterward.

Rousset, physician to Catherine de' Medici, and contemporary of Paré, published a work upon the subject in 1581. This book was translated into Latin about ten years later. The author attempted to prove the possibility of saving the mother and child by means of this operation, but his views were opposed by Paré, Guillemeau and others. In the middle of last century, the subject divided operators into two sections, the *Symphysiens* and *Cæsariens*, or those who advocated division of the symphysis pubis and those who advocated Cæsarean section.

It may be taken as a recognised rule in midwifery that no woman should be allowed to die undelivered without some attempt being made to save her and her offspring, or, at least to save her, even at the expense of her child.

Concerning the latter point, whether we are justified in destroying the infant when alive, there has been, and still exists, difference of opinion, due in some measure to religious belief, and likewise to the personal feeling of the husband, who often felt that very little hope was held out to him that his wife could be saved by section. Among such men we had Napoleon, who, when appealed to by Dubois, said: "Treat the Empress as you would a shopkeeper's wife in the Rue St. Martin, but, if one life must be lost, by all means save the mother." In marked contrast to him we had Henry VIII, who, when thus questioned before the birth of his son Edward, exclaimed: "Save the child by all means, for other wives can be easily found." At the present time such men might be put down as either a good husband but a bad father, or a good father but a bad husband.

The doctrine of the Roman Catholic Church has been that, even though it would be impossible to extract the child without first killing it, to do so would be mortal sin; and likewise, until lately, it was held that the infant could not be baptized in the uterus, as it must be *natus* before it could be *renatus* by baptism.

Of late years, the happy results following Cæsarean section and Porro's operation have done much to efface the dreadful feeling, that we have in such cases to decide whether the life of the mother or that of the child is to have our preference, seeing that it is now quite possible to save both.

Barnes wrote: "Cæsarean section is resorted to with a feeling akin to despair. Embryotomy stands first, and must be adopted in every case where it can be carried out without injuring the mother.

Cæsarean section comes last, and must be resorted to in those cases where embryotomy is either impracticable, or can not be carried out without injuring the mother. There is therefore no election. The law is defined and clear. Cæsarean section is the last refuge of stern necessity."

As against this statement, Barnes has recently said: "It is no longer permitted to us, without ample proof of clear necessity, to sacrifice the child in order to save the mother. The cases in which the two lives are supposed to stand in antagonism are vanishing before the light of modern science and skill."

If anything is needed to sicken one at the revolting practice of craniotomy, it might surely be found in the relation of the obstetrical history of a rhachitic woman, who during her last three confinements was under the care of Murdoch Cameron:

1st	1862	Embryotomy.
2d	1863	Embryotomy (labour induced).
3d	1864	Embryotomy.
4th	1865	Induced labour at half term.
5th		Embryotomy (Birmingham Lying-in Hospital).
6th	1868	Induced labour at half term.
7th	1870	Embryotomy.
8th	1871	Embryotomy (eighth month).
9th	1873	Embryotomy.
10th	1874	Embryotomy.
11th	1875	Induced labour at half term.

We must never forget that we have a sacred trust, and Cameron holds that we have no right to sacrifice a child, however unequal its life may be in some cases to that of the mother. In advocating the preference for section as against craniotomy in the living child, Cameron does so only after very mature consideration, and with a feeling that to do otherwise would be to sacrifice a life which we are bound to preserve. He thinks the time has come when the lives of the mother and child may alike be saved, and prefers to think that an infant come to maturity is destined for something greater than to have its glimmering life extinguished by an accoucheur skilled in the use of a dreadful perforator. Let our motto be, "We live to save and not to destroy."

In another case where the obstetrical history was like the preceding one, Cæsarean section was performed, and the mother has now attained her long-wished-for desire, a living child.

Burns in 24 cases gave 22 deaths, while others gave the death rate as from 50 to 100 per cent.

With such results it is not to be wondered at that so many opposed the operation. In England, for example, accoucheurs condemned it absolutely. In Paris, during half a century, there was not a successful case, although it had been performed about 60 times. In the large maternity hospitals of Paris and Vienna, with from 4,000 to 8,000

confinements in the year, not a single successful case of Cæsarean section has been recorded. No doubt now exists that the great fatality was due to the fact that the operation was only resorted to after other measures had failed.

Indications for the Operation.—As regards the general indications for the operation, of course they vary in the hands of different operators, since some, still looking upon Cæsarean section as a last resource, divide the indications into *absolute* and *relative*. The *absolute* indication exists where the deformity of the pelvis is so pronounced that the passage of even a mutilated fœtus is impossible; while the *relative*, is where a mutilated fœtus may be removed by the natural passage with as good a result for the mother as, or even better than, that afforded by embryotomy. It is here that difference of opinion exists. Baudelocque admitted Cæsarean section in cases with a conjugate diameter under 2½ inches; Cazeaux, under 2 inches; Farnier, 2 inches, and Depaul, from 1½ to 2¼ inches when the child was alive, and under 1½ inch when the fœtus was dead. Stolz advocated Cæsarean section whenever the child was alive, and could not be brought through the natural passage. Other authorities lay down the limits as follows:

Scanzoni, under	3 inches.	Barnes, under	1½ inch.
Naegele, under	2 "	Playfair, under	1½ "
Spiegelberg, under	2 "	Leishman, under	1½ "

Of late years, the good results following Cæsarean section in the hands of Cameron, Leopold, Sänger and other operators, have materially changed the views of many authors, who now favour Cæsarean section more than they have done in the past.

Lusk, at the International Congress held at Washington in 1887, declared that Cæsarean section was preferable to embryotomy, even with a conjugate diameter from 2½ to 3 inches, when the child was alive.

It can well be urged that—

(1) Embryotomy in a very contracted pelvis is as dangerous to the mother as Cæsarean section.

(2) Embryotomy always sacrifices the life of the child, while Cæsarean section gives a living child.

(3) No person has any right to sacrifice a child where they can save it without exposing the mother to any additional risk. For these reasons the operation should be one of election when the child is alive, and it should be performed before the patient is exhausted; in fact, early after labour has commenced, or even at full term before labour sets in, especially in multiparæ. In all cases it should be done before rupture of the membranes, and if possible the patient should be placed under the care of an experienced operator.

Little difficulty is experienced in obtaining the consent of the patient and her friends, and it is better to have her under observation previous to the operation, so as to regulate her diet, and have her prepared for operation beforehand.

A very important point in favour of Cæsarean section is that the Fallopian tubes can be tied and divided, so as to prevent subsequent conception, whereas embryotomy may require to be performed ten or a dozen times.

Besides deformity of the pelvis, other conditions, such as tumours or cancer of the cervix uteri, may exist, which would demand either Cæsarean section or some modification of it.

If the child is dead and the conjugate diameter not under $1\frac{1}{2}$ inch, Cæsarean section should be done.

Rousset, the earliest writer upon this subject, recognised two classes of indications, the one furnished by the fœtus, and the other by the mother. Under the first category he placed excessive size of the fœtus, monstrosities, and faulty positions. Under the second, he placed marked contractions from whatever cause. Some operators would include placenta prævia and puerperal convulsions. Cæsarean section might be advisable in some cases of eclampsia, but a skilful obstetrician would never think of such procedure in the case of placenta prævia. In fact, the operators who advocate this step are surgeons who have little or no experience in obstetrical practice.

Our decision for operation should be based upon the degree of contraction of the pelvis, the size of the child's head, and its reducibility, unless the obstruction is due to some other cause, such as cancer or the presence of a tumour in the pelvic cavity.

Every practitioner should be able to form a fair estimate of the amount of contraction, as it is easier to measure a contracted pelvis than a normal one, and it does not require a highly skilled obstetrician to say before labour has commenced, or during the early stage of the process, that the diameter of the pelvis is, or is not, less than 3 inches; and, as a matter of fact, such a pronouncement should be within the skill of the ordinary practitioner, who should be more than a generally useful person, otherwise he will sink to the level of an ignorant midwife. Not only must he be able to form an estimate of the amount of contraction, but by patient study of normal cases, he should qualify himself to form an opinion as to whether it will be impossible for a living child to pass, and also whether under the difficult circumstances in which he may be placed, it would not be better to send the patient where Cæsarean section could be safely performed, than to extract a mutilated fœtus through a minimum diameter.

With a diameter under $2\frac{1}{2}$ inches, where engagement of the head is impossible, no one should hesitate to advise Cæsarean section, although there will always remain cases, as where the child is dead or a subject of hydrocephalus, in which craniotomy may be resorted to.

Experience alone will enable one to avoid extreme measures in cases where the conjugate diameter measures more than 3 inches; in such cases, the skilled practitioner will weigh the chances between premature induction of labour and symphysiotomy.

There can be no question that Cæsarean section is a highly dan-

gerous operation, but the danger, it should be remembered, depends for the most part on delay, and death most frequently results, not so much from the operation, as from previous operative abuse, which is the just term for all injudicious attempts to extract the fœtus through a deformed natural passage.

Success depends upon prompt interference before the patient is exhausted, as then there is less danger from hemorrhage, delayed shock or peritonitis.

When abdominal section has been resolved upon, another question presents itself, namely, whether Cæsarean section or Porro's operation is preferable. If the former, there still remains to be decided whether the operation shall be accompanied or followed by a removal of the ovaries, or the patient be sterilized by the simple expedient of tying and dividing the Fallopian tubes. This has been done by Cameron in about fifty cases and no harm has resulted, although theorists would have it believed that such a procedure would be surely followed by hematocele. When there is a choice of operation, Cæsarean section is to be preferred, as it can be completed much sooner, and is free from the danger of shock and peritonitis which may complicate Porro's operation.

The **preparation of the patient** will depend upon the urgency of the case. When she is under observation, it is better to confine her to bed for a couple of days beforehand, and the bowels should be moved by an enema and a slight laxative. The abdomen is washed and gently scrubbed, and the parts shaved while the vagina is cleansed and rendered aseptic. The preparation in fact is the same as for any other abdominal section. The operator and his assistants who have to do with the case must be exceptionally careful in cleansing and disinfecting their hands, while the chief nurse should see that the instruments and sponges are sterilized and counted.

Very few **instruments** are necessary. The list should comprise the following:

Scalpels	2	Needles, Hagedorn's 2½-inch straight	20
Blunt-pointed bistoury	1	Pessary, compression	1
Forceps, pressure	8	Silk, antiseptic.	
Dissecting	2	Silkworm gut.	
Scissors.		Adhesive plaster.	
Director	1	Dressings.	

The catheter should always be passed into the bladder shortly before operation. The needles should be threaded in pairs beforehand, with No. 3 Chinese twist silk ligatures, about 20 inches long, and placed in a towel wrung out of 1-to-30 carbolic solution, ready for use.

Palpation will reveal the **position of the fœtus**, and this is all the more important, as from this the attachment or site of the placenta will be known.

Cameron's experience in Cæsarean section has shown him that in dorso-posterior positions the placenta is attached upon the anterior

wall, while in dorso-anterior positions the placenta is upon the posterior wall. Thus:

(*a*) In the first cranial position, or O.L.A., the placenta will be found upon the posterior wall, and somewhat to the right side.

(*b*) In the second cranial position, or O.D.A., the placenta will be upon the posterior wall, and somewhat to the left side.

(*c*) In the third cranial position, or O.D.P., the placenta will be upon the anterior wall, and somewhat to the left side.

(*d*) In the fourth cranial position, or O.L.P., the placenta will be upon the anterior wall, and somewhat to the right side.

The fœtus and placenta will be found in the same relation in the various pelvic positions.

From this information it is easy to know when the uterine incision is likely to cut down upon the placenta, and an idea can also be formed as to how to extract the fœtus.

The Operation.—*The abdominal incision* should be made in the median line as in ovariotomy, and it will vary in situation according to the distention of the abdominal wall.

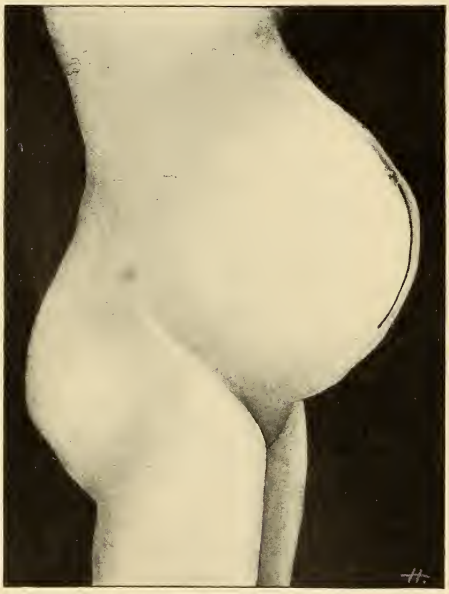

Fig. 200.—"If the abdomen does not droop."—Cameron.

Thus, if the abdomen does not droop (Fig. 200), an incision from 5 to 6 inches in length may be obtained without extending beyond the umbilicus; but when it is pendulous (Fig. 201), the incision must of necessity extend more or less above the umbilicus.

Before opening the uterus, the operator should satisfy himself that that organ is not only in the median line, but that it is not twisted upon its axis. This is settled by locating the position of the Fallopian tubes by means of the fingers. He will frequently find the left tube more or less in front, as the uterus is usually rotated to the right. This displacement must be corrected, and, if necessary, an assistant can easily keep the uterus in position by pressing with his hand on the right side.

When the placenta has its attachment upon the anterior wall the site is seen to bulge, and upon palpation has a fluctuating feeling akin to that of a large pointing abscess.

The next point is to open the uterus with as little loss of blood as possible, and this can be done by placing a flat vulcanite pessary upon the uterine wall around the point to be incised (Fig. 202).

The operator, with the fingers of his left hand, applies pressure upon the pessary, while his assistant does the same on the opposite side. The incision is then made with two or three strokes of the scalpel, and the blood sponged away by the assistant with his right hand. After this has been done, no more bleeding takes place until the placenta is attacked in front, as the pressure with the pessary thoroughly prevents even oozing. Care should be taken not to puncture the membranes, which will soon be observed and recognised by their pearly colour. If the placenta intervenes, this method of pressure is beneficial, not only in preventing bleeding, but also in permitting observation of its tissue, which is recognised by its darker colour.

Whenever the membranes are reached, a director is placed within the opening, which is then enlarged with a blunt-pointed bistoury upward and downward as far as the pessary will admit. At this stage, the compression pessary is removed and the incision extended upward and downward sufficiently to permit the passage of the fœtus. The extension of the incision downward should be limited, as it is likely to interfere with proper contraction of the uterus. Should the placenta intervene, it must be dealt with as a placenta prævia after completing the incision, that is, either separated upon one side, or if central, pierced by the hand. There must be no hesitation in extending the incision, which is made upward and downward from within outward in each direction with a blunt-pointed bistoury, to the length of about 5 or 6 inches. The left hand is inserted without rupturing the membranes till the head is being turned out, or the feet grasped, and then the child should be extracted without delay. On no account should the hand be withdrawn after its insertion, unless during extraction of the fœtus, as the uterus speedily contracts. If the shoulder presents, a hand should be placed upon it to prevent its expulsion, as it adds very

Fig. 201.—"When it is pendulous, the incision must extend more or less above the umbilicus."—Cameron (page 466).

much to the difficulty when any portion of the child's body is allowed to protrude.

The child having been extracted, the assistant places a large flat sponge over the upper angle of the abdominal incision, to prevent the bowels from escaping, and then with both hands grasps the uterus, so as to prevent bleeding.

The cord having been tied and divided, the placenta is immediately removed with the left hand, great care being taken to secure the removal of all membranes and to prevent the entrance of blood into the peritoneal cavity. The assistant now everts the uterus from the cavity, and pushes a flat sponge behind it. The lips of the uterine wound are next everted, the assistant grasping the upper angle and wall with his right hand, and the lower angle and wall with the left. While the assistant holds the wound thus, the operator immediately inserts the silk ligatures, beginning at the middle, each suture grasping the entire wall with the exception of the mucosa (Fig. 203). From seven to ten sutures should suffice, as, with the contraction of the uterus, the incision is greatly diminished.

This accomplished, the sutures are gathered up, a large flat sponge laid over the anterior wall, and another behind. Firm compression or kneading is then made through the sponges with the result that the uterus contracts firmly. The assistant should again seize the uterus as before, while the operator ties the sutures. When this has been accomplished, the whole organ is enveloped in a large, warm, flat sponge, and firm compression is again made so as to insure thorough contraction. Should any oozing appear at the needle punctures, a second warm sponge should be applied, and very slight compression will suffice to overcome any tendency to relaxation. Should the peritoneal edges gape at any points, a few superficial fine sutures should be inserted to bring the margins together.

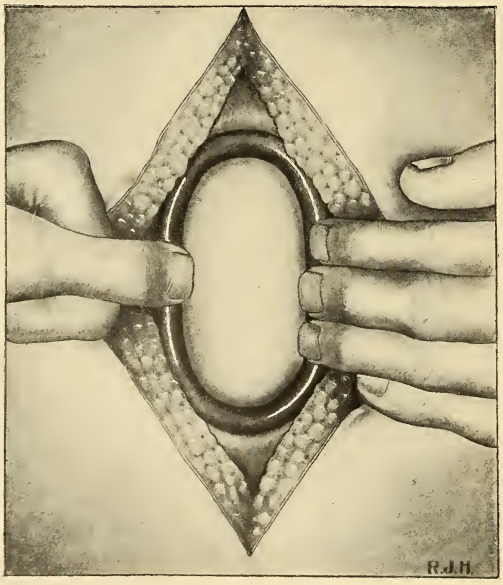

Fig. 202.—"Placing a flat vulcanite pessary upon the uterine wall around the point to be incised."—Cameron (page 467).

The performance of hysterectomy for bleeding is bad treatment,

and indicates that the operator has lost his nerve, as pressure with a warm sponge with both hands never fails to secure thorough contraction.

Several operators advise the introduction of a drainage tube through the cervix and vagina, and the leaving it there to act as a drain. Nothing could be worse. Of course, it is the procedure of a surgeon, but every one who has practised midwifery knows that the presence even of a clot in the uterus may lead to serious hemorrhage. Such a body as a tube, if not expelled, would induce hemorrhage, distention of the uterus, and bursting of the incision with speedy death of the patient. This is no mere theory, but is what has actually taken place where drainage has been resorted to. On no condition should the uterine cavity be washed out or medicated in any way. The less the parts are interfered with the better.

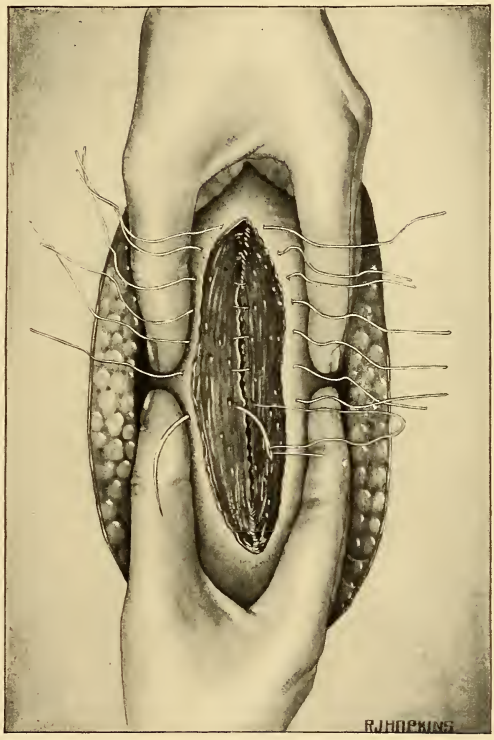

Fig. 203.—"The operator immediately inserts the silk ligatures, each suture grasping the entire wall with the exception of the mucosa."—Cameron (page 468).

After the ligatures have been cut short, the next step is to ligature the Fallopian tubes with antiseptic silk and divide them, in order to prevent future conception. Of course, the consent of the patient for this procedure should be obtained beforehand. Two ligatures are tied upon each tube, which is then divided between those points. This method is effective, and leads to no complications or bad results, nor is menstruation interfered with. The cavity is next cleaned by the removal of all clots, etc., and the uterus replaced. The external wound in the parietes is closed in the usual way with silkworm sutures. The vagina should now be cleansed of all clots and sponged out, after which an antiseptic pad should be applied to the vulva.

The wound should be dusted with iodoform, and a few layers of gauze placed over the wound. This should be secured with plaster, to prevent both slipping of the dressing and strain on the sutures,

in case of sickness or cough. A sheet of gamgee or other dry absorbent dressing is next applied, and then the bandage.

The after-treatment consists of sips of warm water, say a teaspoonful every fifteen minutes for twelve or twenty-four hours, after which milk and soda may be given in increasing quantities. For a few nights, half a grain of morphine in suppository is given. The urine should be drawn off every six hours for two or three days, care being taken to cleanse the parts thoroughly before doing so.

On the fourth day, an enema of two teaspoonfuls of glycerine in two ounces of soapy water is administered, and, if necessary, some slight aperient by the mouth. The bowels having been moved, the patient is allowed chicken soup, fish, eggs, beef tea, etc. If the child is to be nursed, it may be put to the breast on the second or third day.

The abdominal sutures may be removed in from ten to fourteen days, and the patient allowed to rise at the end of four weeks. She should always wear an abdominal belt, and should be warned against kneeling when scrubbing floors, etc., as this is apt to induce hernia from pressure and stretching of the cicatrix.

In review, it may be explained that rupture of the membranes, either intentionally or by labour, means a contraction of the uterine wall, and as a consequence a greater wounding of the uterine tissue, in order to secure a sufficient opening to extract the child. Some operators, instead of using manual or pessary compression to prevent bleeding when opening the uterus, employ an elastic ligature. The uterus is first everted, and the elastic ligature is then passed round the cervix. This not only necessitates a much larger abdominal incision, but also induces asphyxia of the fœtus and causes inertia of the uterus, as the organ does not so readily respond to kneading. Its employment is therefore conducive to hemorrhage. Veit, Doléris, and Pajot, have blamed it for causing death from hemorrhage, and Zweifel, Sänger, and Lusk, have also noticed this complication.

Carniso advised the early removal of the ligature.

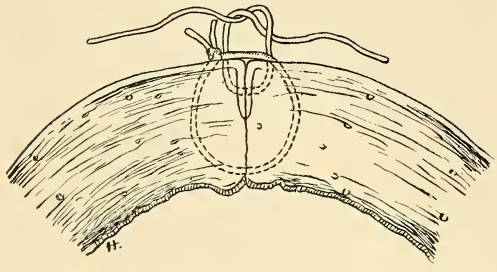

Fig. 204.—"Sänger's method is another way of dealing with the uterine incision."—Cameron.

Sänger's method is another way of dealing with the uterine incision (Fig. 204). In this procedure, the muscular wall of the uterus is closed with from ten to fifteen sutures which approximate to, but do not include, the mucosa, and between each suture two superficial sutures are inserted to unite peritoneum to peritoneum. Formerly, the peritoneum was separated from the muscularis, and a wedge-shaped piece of muscularis was

removed from each side, the base of the wedge being outermost. This done, the peritoneal flaps were folded into the wound and secured by the superficial stitches. Such a detailed process is quite unnecessary, as the sutures as recommended by Cameron secure perfect apposition, not only of the muscular tissue, but also of the peritoneum. In fact, most operators now make use of only eight or ten deep sutures, and reserve superficial sutures to secure contact where there is any gaping between the stitches. Such unevenness can be readily avoided by beginning in the middle and working toward each end, and by taking care to keep the sutures at regular intervals.

Porro's Modification.—The fatal results following the early Cæsarean section led to a modification of the operation. It had been found by experiment that the uterus in pregnant rabbits could be removed with better results than by simple section, and therefore it was concluded that similar results would follow in the case of women.

Blundell, in writing upon this subject, said such a method might prove an eminent and valuable improvement, but he also wrote, in speaking of deaths from peritonitis after Cæsarean section, that experience sometimes contradicted our most cherished opinions, and that something of the kind would be found to occur in the cases under consideration, as he had no doubt that the risk of diffused peritonitis had been greatly exaggerated. How his surmise has proved true, is seen in the present-day position of abdominal surgery.

Acting on the lines suggested, Storer, of Boston, in 1868, first practised amputation of the uterus after section. The case was one of pregnancy complicated with a fibroid of the uterus. He was interrupted by such an alarming hemorrhage that he had to remove the body and fundus with the ovaries, but his patient died three days afterward. This was an operation of necessity.

Porro first performed the operation as a matter of choice, as he considered it impossible to secure the uterine incision in Cæsarean section so fully as to prevent the flow of blood and septic fluid into the peritoneal cavity. The results obtained under antiseptics in other abdominal operations encouraged him to make the attempt, and in 1876 he did so with happy results. Others took up the operation, and very quickly the old Cæsarean section was superseded by it; but only for a few years, for Cæsarean section can now be performed without the slightest danger from bleeding, peritonitis, septicæmia, or other dangers, that Porro's operation sought to avert.

At the present day, Porro's operation is an operation of exception, that is, only necessary in some conditions, such as serious rupture of the uterus, or where labour is obstructed by a large fibroid. As regards the steps of the operation, it is at the beginning similar to Cæsarean section. But after the uterus has been emptied it varies, inasmuch as at this point the uterus is everted and an elastic ligature applied round it, just above the os internum. The uterine tissues are then

compressed until the bleeding has ceased. Then the uterus is removed, the stump secured outside the abdominal wound, and maintained in position by needles and a serre-nœud.

Porro, upon emptying the uterus, transfixed it with a trocar and cannula at the union of the body and cervix. He then withdrew the trocar and passed two silver wires through the cannula, which was also withdrawn and the wires tied, one upon the right and the other upon the left side, including in their grasp the ovaries and tubes. This done, the uterus and appendages above the wires were cut away, while the stump was secured outside. The method has been improved by transfixing with needles and ligating with a serre-nœud instead of with separate wires.

The stump is dusted with iodoform, and dressed with gauze all round. The needles should be raised to allow of proper packing. A layer of sublimated gamgee or other dry absorbent dressing should be placed over all. It may require to be dressed daily, and the ligated portion usually separates about the tenth day, but the raw cavity requires regular dressing until perfectly healed.

It was urged as an important factor that Porro's operation prevented future conceptions, but this end is gained in Cæsarean section by the more simple method of tying and dividing the tubes.

Some operators now prefer to remove the entire uterus.

CHAPTER XXXI

MALFORMATIONS AND DISPLACEMENTS OF THE FALLOPIAN TUBES

Absence and defective development of the tubes — Supernumerary and accessory tubes and ostia—Displacements of the Fallopian tubes.

The Fallopian tubes develop from the upper ends of the two Müllerian ducts. Their *anlagen* are first solid and cordlike and later become hollow tubes, and their lower limit is marked by the *anlage* of the round ligament. Below this level the Müllerian ducts unite to form the uterus and vagina. Their malformations may be marked by the characters of defect, of excess, or of altered relation. During fœtal life each Fallopian tube shows several spiral convolutions.

Absence and Defective Development of the Tubes.—Absence of both tubes is very rare, and when it occurs it is nearly always associated with absence of the uterus. A less rare anomaly is absence of one tube, and in such a case the corresponding ovary is said to be usually wanting also; but this is probably less often so than has been thought, for the gland may be present in a rudimentary state, as in the specimen described by Blot (*Comptes rendus de la Société de biologie*, 2. s., vol. iii, p. 176, 1857), or in an unusual position in the abdominal cavity. Very frequently the defect is associated with the uterine malformation known as uterus unicornis; it is easy to understand this combination of defects when it is borne in mind that the tube and the corresponding half of the uterus are both developed from the same duct of Müller. Unilateral absence of the tube is not necessarily accompanied by interference with the reproductive functions, for Chavannaz (*Journal de médecine de Bordeaux*, vol. xxvi, p. 361, 1896) has recorded the case of a woman of sixty who had menstruated regularly and had borne three children, and who yet possessed (as was found out at the autopsy) neither tube nor ovary on the right side. The kidney of the same side may also be wanting, as in Edridge-Green's case (*British Medical Journal*, 1895, vol. i, p. 416). The Fallopian tube may be absent in part, for Ballantyne and Williams (*Structures in the Mesosalpinx*, p. 26, 1893) have described a case of genital tuberculosis in which the outer two thirds of the right tube was completely wanting and the inner third ended in a tapering conelike extremity (Fig. 205). Sometimes the tube shows its rudimentary development by its solid state or by imperforation of its abdominal end, anomalies which a knowledge

of embryology makes it easy to comprehend. Another form which rudimentary development of the tube may take, is persistence of the spiral convolutions which are normally present in fœtal life; it is doubtful whether these twists represent a return to the fœtal state or a continuance of it; they must predispose to the occurrence of hydrosalpinx, and they may lead to sterility and dysmenorrhœa.

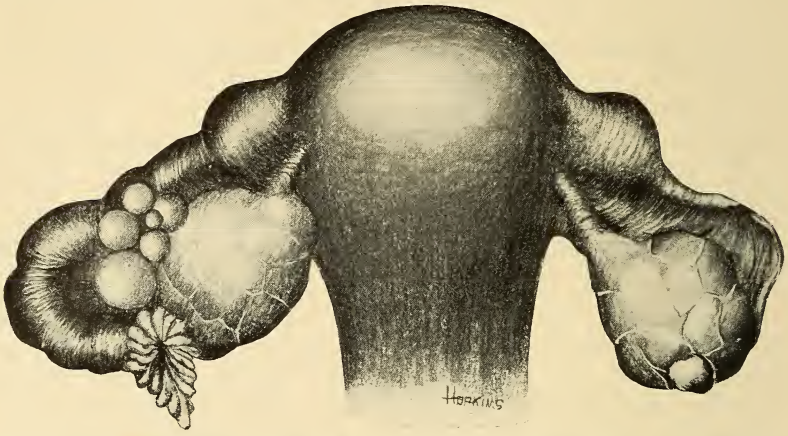

Fig. 205.—"A case of genital tuberculosis in which the outer two thirds of the right tube was completely wanting and the inner third ended in a tapering conelike extremity." —Ballantyne (page 473).

Supernumerary and Accessory Tubes and Ostia.—Cases of *supernumerary* or *double tubes* are exceedingly rare; but instances of accessory ostia or of small tubes attached to the broad ligament or to the Fallopian tube itself are comparatively common. It is not difficult to understand why this should be so, for in the former case it is necessary to suppose the existence of two Müllerian ducts on one side, while in the latter the condition may be explained by anomalous development of a single duct. An example of true double tube (on the right side) was reported by Winckel (*Lehrbuch*, p. 595, 1886); there was a third ovary lying in front of the uterus, and attached to it was a cordlike structure with a fimbriated end which passed to the right side and was connected with the right Fallopian tube; the patient was sterile. The case described by Ruppolt (*Archiv für Gynäkologie*, vol. xlvii, p. 646, 1894) must be looked upon as one of constriction of a Fallopian tube by fœtal peritonitis, and not as true duplication of the tube. With regard to Wetherill's case of "supernumerary oviducts" (*American Journal of Obstetrics*, vol. xxxiv, p. 373, 1896), some doubt must also exist as to whether the tubes running in the broad ligaments below and parallel with the normal Fallopian tubes were really salpingeal in nature or not.

Accessory ostia and tubes are, as has been said, not so uncommon. Ballantyne and Williams (*Structures in the Mesosalpinx*, p. 25, 1893) met with two instances of accessory ostia in sixty-one pairs of tubes from

consecutive post-mortems at the Edinburgh Royal Infirmary. Usually, one accessory ostium only is present (Fig. 206), and it is situated on the upper margin of the tube not far from its normal ostium; but Ferraresi (*Annali di ostetricia, ginecologia e pediatria*, vol. xvi, p. 521, 1894) has put on record a remarkable case in which there were six ostia in all. They are either sessile on the normal tube or have longer or shorter pedicles connecting them with it. These pedicles may be hollow, and generally the ostia are surrounded by fimbriæ and communicate with the tubal lumen. They may arise either from imperfect closure of the groove in the germinal epithelium which ultimately becomes the upper end of the duct of Müller, or from secondary opening of the duct after it has been closed. The structures which have been described must not be confounded with what have been called "tubal appendages" or "pedunculated tufts of fimbriæ." These are solid stalks bearing numerous fimbriæ on their free end, and they usually spring from the broad ligament in the neighbourhood of the parovarium. Ballantyne and Williams (*loc. cit.*, p. 45) have shown how frequently stalked cysts of the tubules of Kobelt occupy this position (Fig. 207), and it is quite possible, as Bland Sutton suggests, that the pedunculated tufts of fimbriæ are simply ruptured cysts of Kobelt's tubes. A comparison of Ballantyne and Williams's representation of such a cyst and Kube's case of accessory tubal appendages (Fig. 208) will strengthen this view. It is noteworthy, however, that in the dis-

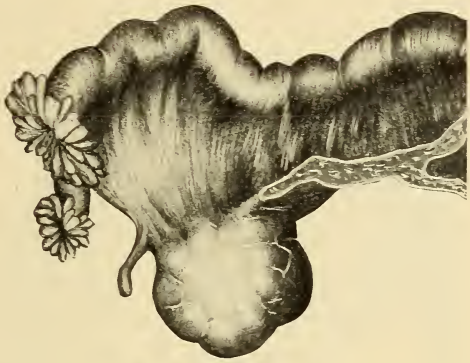

Fig. 206.—"Usually, one accessory ostium only is present."—Ballantyne.

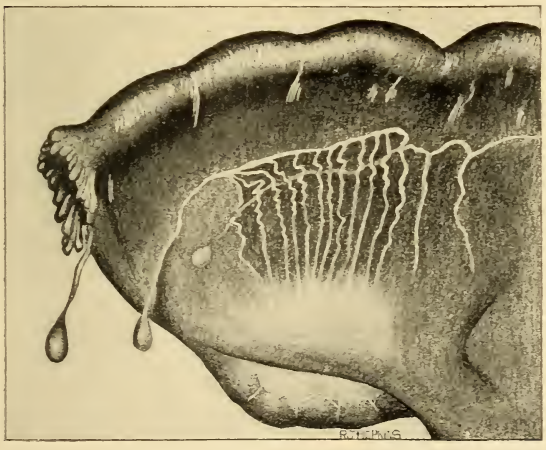

Fig. 207.—"Frequently stalked cysts of the tubules of Kobelt occupy this position."—Ballantyne.

cussion which followed the reading of Kube's paper (*Journal Akouscherstva I Gienskich Boliesney*, vol. ix, p. 458, 1895), Massen stated that so-called parovarian cysts might arise from these accessory tufts of fimbriæ. The question must, therefore, be left undecided in the mean-

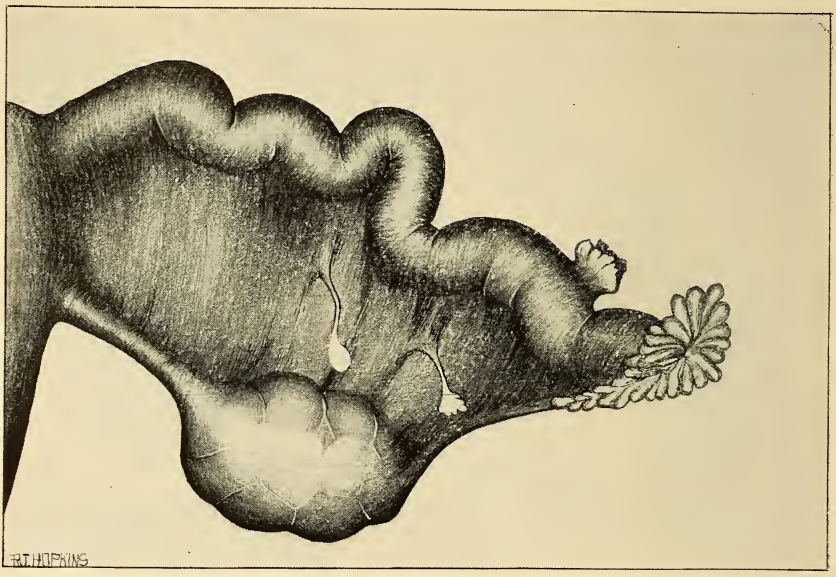

Fig. 208.—"Kube's case of accessory tubal appendages."—Ballantyne (page 475).

time. Tubal diverticula are sometimes met with, and it has been hazarded that their rupture, followed by the prolapse of the tubal folds through the opening thus formed, may lead to the production of an accessory ostium.

From the clinical standpoint, accessory tubal ostia and diverticula are not unimportant; indeed, the opinion has of late years been growing that they stand in very close relation with the causation of extra-uterine gestation. Thus Henrotin and Herzog (*Revue de gynécologie et de chirurgie abdominale*, vol. ii, p. 633, 1898) have reported two cases in which they regarded tubal malformations as the cause of ectopic pregnancy: in one, the abdomen was opened for symptoms of tubal rupture, and it was found that below the right tube was a small accessory tube with a complete ostium abdominale, and in it a sac containing blood clot, decidual cells, and chorionic villi; in the other, the uterus and appendages were removed for long-continued pelvic symptoms, and it was seen that from the left Fallopian tube near its middle a diverticulum projected toward the uterus, and in this there were also blood clot, decidual cells, and chorionic villi. On the other hand, an accessory ostium tubæ may render possible the occurrence of pregnancy when the normal tubal ostia on both sides of the body are closed by inflammatory adhesions, as in the remarkable case described by Sänger

(*Monatsschrift für Geburtshülfe und Gynäkologie*, 1895, vol. i, p. 21, Bovée (*National Medical Review*, July, 1899) reported a case in which, in an operation for adhesion of the appendages and retroversion of the uterus, examination of the right appendage showed two fimbriated tube ends. Through the upper tube a probe could be passed almost to the uterine cornu; the other was permeable to the probe for about 2 inches, but as the passage of a probe all the way to the uterine from the ampullar end of a tube is rarely possible, it seemed probable that there were really two similar, normal tubes in this case.

Displacements of the Fallopian Tubes.—The tube, like the ovary, may be congenitally displaced. It may, for instance, be at a higher level than normal in the abdominal cavity. In the case of a newborn infant, J. W. Ballantyne (*Transactions of the Edinburgh Obstetrical Society*, vol. xv, p. 56, 1890) found the right Fallopian tube adherent, through fœtal peritonitis, to the peritoneal aspect of the cæcum; and M. L. Harris (*American Gynecological and Obstetrical Journal*, vol. viii, p. 45, 1896) discovered, during abdominal section performed for menstrual pain, that the right tube was much longer than usual and passed to the right ovary which lay on the psoas magnus as high as the bifurcation of the aorta. A case is on record (Hüter, *Monatsschrift für Geburtshülfe*, vol. xxv, p. 424, 1865) in which the tubes were displaced backward, and were united behind the uterus by their ostia, forming a ring. Another type of tubal displacement is herniation. Just as hernia of the ovary into the inguinal canal may occur, so the tube may find its way in the same direction. Usually, the tube is herniated along with the ovary (see Malformations of the Ovary), but in exceptional cases it has been met with alone. Thus, Pierre Wiart (*Bullétins et mémoires de la Société anatomique de Paris*, 6. s., vol. i, p. 59, 1899) has reported the case of a six-months'-old child with hydrocephalus, in which the uterus was displaced toward the left side, the tube and round ligament of the same side were engaged in the abdominal opening of the inguinal canal, and the tube inside the canal was disposed in the shape of an almost complete O, the fimbriated end coming nearly into contact with the part immediately projecting from the orifice. The ovary lay near to the opening but did not engage in it. It is probable that this form of hernia is more common than has been thought; it may be present at, or soon after, birth and be reduced by the rearrangement which takes place among the abdominal and pelvic viscera in the first year of life. If it persists, it may give rise in later life to dysmenorrhœa, perhaps also to sterility.

CHAPTER XXXII

NEOPLASMS OF THE FALLOPIAN TUBES

Benign neoplasms: papillomata; cystomata; lipomata; fibromyomata—Malignant neoplasms: carcinomata; sarcomata.

Adventitious growths of the Fallopian tubes are of comparatively rare occurrence and of but relatively small clinical importance. Little has been written upon this subject, and, for our present knowledge, we are indebted chiefly to Bland Sutton, Orthmann, Clark, and Doléris. A systematic study of these growths must be based upon the fact emphasized by Coe that the Fallopian tubes are but extensions of the uterus itself and contain the same histologic elements; and that they are, therefore, liable in a certain degree to the same neoplastic changes. Growths originating in these structures, like those originating elsewhere, are divisible into benign and malignant.

The benign neoplasms of the Fallopian tubes, so far as described, are (*a*) papillomata, (*b*) cystomata, (*c*) lipomata, (*d*) fibromyomata.

Papillomata occurring in the Fallopian tubes have been carefully studied by Clark. Doran was the first to call attention to the subject which has been carefully elaborated by Sänger and Barth. Bland Sutton, who has reported two cases, has demonstrated the fact that the mucous membrane of the Fallopian tubes contains glands the adenomatous tissue of which may become the starting point of true homologous papillomata. This theory, however, has been rejected by Sänger and Barth. Papillomata in the tubes manifest themselves by the development of a tumour, which is generally the first symptom to attract the patient's attention. This growth becomes painful and may confine the patient to bed with repeated attacks of peritonitis. The tumour may be globular, elastic, and fluctuating, and may possess a varying degree of mobility. It may be small or it may be large enough to produce lateral displacements of the uterus with obscuration of its fundus. In Slansky's case, which comprised the basis of Clark's article, the tumour was about half the size of a man's head, presenting at one spot an amputated surface about 4 centimetres square, at one point of which was a short pedicle having the appearance of the enlarged uterine end of the Fallopian tube; close to the point of amputation was an irregularly torn opening through which the contents of the cyst had escaped. The external surface of the tumour was smooth, containing a few large dilated blood vessels and showing in the deeper

layers occasional necrotic areas. The internal surface was covered with a thick papillary growth, consisting of multiple funguslike excrescences which, in some areas, were massed together in thick, dense clumps, presenting a typical cauliflower appearance. The papillæ varied from delicate fimbriæ to large, fusiform projections containing small cysts. There were occasional areas devoid of excrescences. The *morbid histology* of tubal papillomata is accurately described by Clark (*Bulletin of the Johns Hopkins Hospital*), who found that sections through the circular folds showed a greatly attenuated cyst wall measuring only 0.05 to 0.1 centimetre in thickness. Peritoneum, circular muscle fibres, a thin stratum of connective tissue, longitudinal muscle fibres, followed by a denser layer of connective tissue upon which rested one layer of columnar epithelium, arranged in regular order, were shown upon the slide in consecutive striæ. Except in the baylike projections between the folds, the epithelium was nonciliated, and, even in these spaces, the ciliated cells were only rarely found. Clark's further description of the microscopic appearances is as follows:

"Numerous large dilated blood vessels occupy the connective-tissue layer beneath the epithelium. The folds of the Fallopian tube, as such, are no longer present, but are represented by sessile and pedunculated papillary growths.

"The low sessile projections are composed of dense connective tissue, like that seen in chronic inflammation of the tube, whose cells extend at right angles from the underlying circular fibres, forming warty prominences clad with one layer of columnar epithelium which gradually shades off into the low columnar and cuboidal variety as the domes of the projections are reached. Besides the sessile excrescences there are a few long, slender processes to which are attached daughter offshoots. The main stem in all instances contains large dilated blood vessels. The connective tissue forming the stroma of these papillæ shows a marked variation in its structure in different areas. At the bases of the papillæ the cells are closely crowded together and contain deeply-staining spindle-shaped nuclei. This appearance is maintained until the apices or domes of the growths are approached, when the cells gradually become hyaline, and in turn shade off into a pure mucoid degeneration.

"Sections from the thicker portions of the cyst wall (0.5 centimetre thick) show unstriated muscle fibres scattered very sparsely among the connective-tissue fibres which make up the chief part of the section. The internal surface of the cyst wall is covered with innumerable, vigorous growing papillomata, whose main stems extend far out into the lumen of the cyst, forming the most complicated, coral-like systems. The offshoots have, in many instances, coalesced, forming spaces which contain small papillary growths.

"In some instances the main stems have become adherent to each other, inclosing much larger glandlike spaces. The mucoid degeneration noted above is even more marked here, and in the large fusiform

ends of some of the branches the entire stroma has undergone this transformation, giving the cystic appearance noted in the macroscopical description. Hemorrhage has occurred into some of these spaces containing the mucous tissue, leaving a granular *débris* which stains a bright yellow by Van Gieson's method.

"The ends undergoing degeneration are covered by one layer of shrunken cuboidal epithelium, which rests upon a thin layer of hyaline connective tissue. Besides the cystic spaces formed by the fusion of the papillomata, others are found occupying a deeper portion of the cyst wall, lined by cuboidal epithelium and surrounded by a dense connective-tissue stroma like those seen in 'sacto-salpinx pseudo-follicularis.' (Martin.)

"In one of these spaces a small papilloma is seen in process of formation. The single layer of cuboidal epithelium lining the cavity forms an uninterrupted line, except at one point, where it assumes a columnar shape and becomes heaped upon a delicate connective-tissue papilla projecting from the main stroma."

The *symptoms* of papillomata of the ovary are simply those of an intrapelvic tumour. They are painful but not more so than certain dermoids. Their tendency to rupture of the tube or capsule in which they develop, results in the escape of blood and of the products of degeneration into the peritoneal cavity, causing inflammation of that membrane. In none of the cases so far reported, only six in number, has a diagnosis been made before operation. The *treatment* consists in the removal of the tumour by abdominal section. In view of the fact emphasized by Williams that all papillomatous growths have a tendency to undergo malignant degeneration, this form of neoplasm, rare as it is, furnishes another reason for prompt intervention in the presence of a pelvic tumour of undetermined character.

Cystomata of the Fallopian tubes are generally of rare occurrence, of insignificant size, and of but little clinical interest. They may originate either within the serous coat or the muscularis, although their favourite site of development is from the vestibular mucosa. It is probable that they are inflammatory products, in the sense that mucous follicles have become occluded and thus converted into retention cysts. Sutton has reported a large cyst which developed in the muscularis and attained the size of a walnut, the probable origin of which was similar to that observed by Kiwisch in the submucosa, and which was demonstrably of inflammatory origin. A. Martin has published an interesting picture showing the cysts and other growths that develop about the vestibule (Fig. 209).

Lipomata can hardly be spoken of in the plural, when indicating these growths as they develop in the Fallopian tubes. Their existence, so far as available records indicate, depends upon the report of a single case by Rokitansky. The neoplasm in that case was about the size of a walnut. The condition is symptomless and without clinical interest.

Fibromyomata may develop from the muscularis of the tube. Hypertrophy and hyperplasia of this tunic are not infrequent sequelæ of salpingitis, and have been noted by Sutton as accompaniments of fibroid degeneration of the uterus. These areas of hyperplasia may be

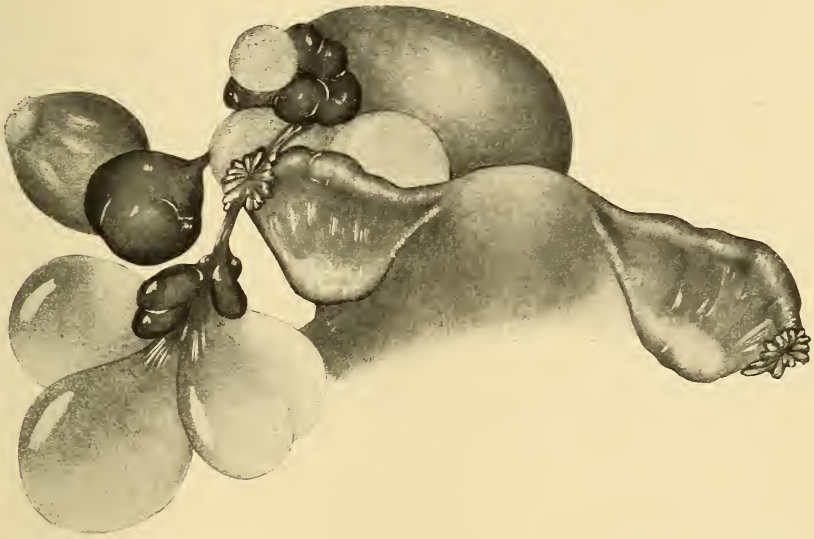

Fig. 209.—"A. Martin has published an interesting picture showing cysts and other growths that develop about the vestibule."—Reed (page 480).

more or less limited by bands of constriction which give to them the appearance of myomatous degeneration. As pointed out by Coe, however, they are not true neoplasms. These latter are relatively of smaller size, rarely more than from 1 to 2 centimetres in diameter, although Speth's case, which is accepted as reliable, was about 4 centimetres in diameter. These nodules may be interstitial, but are generally subserous and pedunculated. They abound more in muscular than fibrous tissue. They belong to the curiosities of pathology, and are rarely productive of symptoms.

Malignant neoplasms of the Fallopian tubes are (*a*) carcinomata and (*b*) sarcomata.

Carcinomata occur in the tubes usually as the result of extension of the disease from the corporeal endometrium. It has been asserted that metastasis of carcinoma from the uterus to the tubes is of very rare occurrence. Kiwisch found carcinoma of the tube only 18 times in 73 cases of cancer of the uterus, and Dittrich in only 4 cases out of 94 of general carcinomatosis. Orthmann, in a communication on this subject to the Gynecological Society of Berlin (*Centralblatt für Gynäkologie*), stated that a careful research of the literature of the subject yielded accurate descriptions of only 13 cases, in 9 of which the uterus and in 4 the ovaries were primarily affected. The disease

may occur primarily in the tubes. This was true in 1 out of 3 cases occurring in Martin's clinic. The fact that metastasis to the tubes is of such rare occurrence is explained, according to Olshausen, by the distribution of the lymphatics, which do not favour the migration of morbific elements from either the ovaries or the uterus to the oviducts.

Sarcomata are of infrequent occurrence in the Fallopian tubes. The reports of the few cases which have been recorded raise some doubt as to the exact character of the neoplasm. The histologic elements are usually so diverse that the growth itself is hardly susceptible of exact classification. The preponderance of connective-tissue elements, occurring in connection with other forms of cell growth, has generally resulted in the designation of the tumour as a sarcoma, or, more properly, a myxosarcoma. These tumours rarely attain the size reached by true sarcomata in other localities. Their growth is generally more rapid than that of benign neoplasms, or, indeed, of the papillomata, the benignity of which is open to suspicion. Their *symptomatology* is simply that of a pelvic tumour, the existence of which should always be regarded as an indication for an incision undertaken for diagnostic purposes. In this suggestion lies the correct indication for *treatment* of these cases.

CHAPTER XXXIII

INFECTIONS AND INFLAMMATIONS OF THE FALLOPIAN TUBES

Infections in general—Bacteria of the Fallopian tubes in health—Bacteria of the Fallopian tubes in disease—Relations of infections to inflammations of the tubes—Catarrhal salpingitis—Morbid histology of salpingitis: (*a*) acute, (*b*) chronic—Hydrosalpinx—Hematosalpinx—Pyosalpinx—Symptoms and diagnosis of salpingitis.

Infections of the Fallopian Tubes.—The Fallopian tubes are frequently the seat of infection. It may be said that, aside from neoplasms, which are rare, and malformations, which are still more rare, infections of the Fallopian tube cause, either directly or indirectly, practically all the diseased conditions which in those structures demand the attention of the practitioner. It is true that many of the infections of the Fallopian tube can not be distinguished from each other by present clinical methods; this fact, however, must not be accepted as a final barrier to either the present consideration or the future investigation of these conditions from the standpoint of their causation. The constant improvement in methods of investigation is resulting in the progressive revelation of new and important facts relative to the bacteriology and the histo-pathology of the Fallopian tubes, as of other structures of the body. While this fact is recognised and acted upon, the outlook must be accepted as promising. Thus, Reymond (*Annals of Surgery*) found streptococci in a number of cases which a few years previously would have been considered sterile salpingitis, but in which, by means of improved methods, the micro-organisms were discovered. Practically all the progress which has been made in this department has been realized, step by step, by such painstaking investigations. The point at which we have arrived, justifies the consideration of all inflammatory diseases of the Fallopian tubes as of infectious origin, although the dominant micro-organism upon which the infection depends, can not be isolated in all cases. A systematic consideration of the subject must take into account (*a*) the bacteria of the Fallopian tube in health; (*b*) the bacteria of the Fallopian tube in disease; (*c*) the general pathology of inflammation of the tubes induced by infections in general; (*d*) individual infections; and (*e*) treatment.

The **bacteria of the Fallopian tubes in health** have been investigated by Sinclair, who points out the fact that, from the bacteriological point of view, it is well to keep in mind that the Fallopian tube has two openings, one extremely narrow, connecting it with the cavity of the uterus, and the other, the wide abdominal orifice connecting it with the peritoneal cavity.

Invasion of the tube by bacteria may occur from either end, or through its walls under special conditions. The cavity of the uterus in health is free from germs and so is the peritoneal cavity. Invasion through the walls of the tube only occurs in adhesion to the intestine or from bacterial disease in the pelvis. Consequently in a state of health the Fallopian tube is entirely free from germs.

Witte examined freshly extirpated and apparently healthy tubes in 11 cases. In 9 cases, the cultivation remained absolutely sterile. In one of the remaining cases he found both the staphylococcus and the streptococcus, in the other only a sparse growth of the staphylococcus. The corresponding uterus in each case was examined at the same time, and, in the cervical canal of the first, the streptococcus and staphylococcus were found. In the second uterus, the staphylococcus was discovered in the cavity of the body. In spite of the obvious cause of the presence of bacteria in the tubes, Witte drew the general inference that the healthy tubes might contain microorganisms.

Winter examined 40 tubes which had just been obtained by operation. He employed the usual methods of cultivation in searching for bacteria, and, although there were a few exceptions of which he considered the explanation satisfactory, he concluded that the healthy tube was free from bacteria.

Menge examined 83 tubes obtained from 50 women operated upon for various reasons. Exact examination by the microscope and by cultivation experiments in various ways may be assumed. He came to the same conclusion as Winter, namely, that "the normal tube is always germ-free."

It is possible that the tubercle bacillus may be found in or about the apparently healthy tube in very minute areas of infection, but it is a circumstance which must be extremely rare, and not to be discussed here without entire disregard of proportion. The pathogenic bacteria of every other sort produce marked tissue changes immediately after invading the tube.

The **bacteria of the Fallopian tubes in disease** are of extreme importance, for, as already stated, and as emphasized by Sinclair, among the diseases of the tubes which must be referred to bacterial invasion, we find all, almost without exception, with which we have to deal in gynecological practice.

For the production of a serous collection in the Fallopian tube (hydrosalpinx), two things are necessary: on the positive side, the occurrence more or less remotely of sufficient perisalpingitis to close the

abdominal orifice; and on the negative, the absence of such an amount of bacterial infection as will permit the fluid distending the tube to remain clear. The most common form of hydrosalpinx, that with the walls thin and translucent owing to the great distention of the tube, usually shows signs of pre-existing inflammation in addition to the sealing up of the ostium abdominale; but it is hardly conceivable that any virulent bacterial infection at any previous time could leave so few traces of its existence.

In the form of hydrosalpinx, where the walls are thick and comparatively hard, the anatomical changes may be, and most likely are, produced by the work of pathogenic bacteria of such a modified virulence, or in such small quantity, as not to produce pyosalpinx.

To leave theory and come to the results of the comparatively small amount of work that has been done in the bacteriology of hydrosalpinx; the examinations made by Menge on 20 cases of hydrosalpinx and 3 of hematosalpinx gave an absolutely negative result. The usual care was exercised, and a great variety of cultivation methods were adopted, including the methods and media employed in the search for the bacillus tuberculosis, and yet the results indicated the entire absence of any germs which could be seen with the microscope or cultivated by any of our known methods.

It is interesting to notice that the conservative method of dealing with hydrosalpinx by simple incision, or its equivalent, has received *post-factum* justification from the bacteriologists.

The *bacteria of purulent inflammations* (pyosalpinx) are beginning to be better understood. It is only a short time since we hardly knew of the existence of diseases of the Fallopian tubes. In the last decade and a little more, they have been more exactly and effectively studied, owing to the wealth of material obtained by the introduction of radical surgical treatment. The tendency now is to set down all the more severe forms to bacterial invasion, especially by the gonococcus and the pathogenic bacteria, which produce endometritis in childbed. Ever since Westermark, in 1886, announced the discovery of the gonococcus in the pus of a pyosalpinx, innumerable investigations to prove or disprove the bacterial origin of tubal disease have been undertaken, and the contributions to the bacteriology of the subject have been voluminous in the extreme, and, as usual, many-voiced and often contradictory. In addition to the study of the gonococcus and other pathogenic micro-organisms, many observations, both clinical and bacteriological, have been made upon the phenomena of tuberculosis of the tubes and ovaries with an exactitude unknown before the era of gynecological surgery.

The conclusion which receives practically unanimous support is, that *the gonococcus is by far the most frequent cause of purulent salpingitis.*

Wertheim, who was among the first to publish any considerable number of exactly observed cases from the bacteriological standpoint,

found that out of 24 cases, the products of inflammation were sterile in 6; the gonococcus was found in 16; in 1 case the streptococcus was found, and in 1, the pus contained a bacterium which he could not identify. Wertheim, like most observers, found that the gonococcus held the first place as the producer of pyosalpinx, and that other bacteria were the agents only occasionally. He did not see reason to believe that the gonococcus prepared the way for secondary invasion by pyogenic organisms. As a rule, when the gonococcus is present no other bacteria are found.

Menge's results in his first series of cases in which the Fallopian tubes were the seat of inflammation, were much the same as Wertheim's. The gonococcus was the most common cause of the disease, but the streptococcus and staphylococcus were occasionally found, and, in a very few cases, the *Diplococcus pneumoniæ* and the *Bacillus tuberculosis*. In the great majority of cases, the pus in pyosalpinx sacs was sterile, and a mixed infection was found to exist in the tubes only when they were adherent to other viscera. Adhesion to the intestine owing to bacterial inflammation appears to lead to the passage of bacteria by softening of the tissues, or by actual communication through an orifice formed by destruction of tissues. The other, more ordinary, ways in which bacteria gain access are well known. They are chiefly by extension of endometritis of bacterial origin upward, or by invasion from above, usually by the tubercle bacillus.

The war of words and opinions regarding "mixed infection" has been waged chiefly around pyosalpinx and the relations of the gonococcus to other pyogenic organisms. It is agreed that the gonococcus does not incline toward symbiosis, but there can be no doubt that it is found occasionally in company with saprophytes and pathogenic organisms. The discussion has some bearings on practical gynecology, e. g., there can be no doubt that gonorrhœa may extend to Fallopian tubes already invaded by the slowly acting *Bacillus tuberculosis*; and the clinical facts, as well as bacteriological investigations, show that an acute puerperal endometritis, primarily due to the streptococcous infection, may be influenced for the worse by the spread of gonococcous infection from the cervix. Isolated observations like that of Krönig, in which a gonorrhœal endometritis was cured through a puerperal infection by the streptococcus, and a vulvo-vaginitis by an attack of erysipelas in the neighbourhood of the parts, are as yet mere riddles with no place in any ordered set of well-supported opinions. Upon the whole, however, it may be confidently alleged that the subject of "mixed infection" is of interest almost entirely for the bacteriologist as distinguished from the gynecologist.

The *bacteriology of chronic salpingitis* is of considerable interest. In cases operated upon, the tissues are often so much hypertrophied as to give the impression, at the time of pre-operation diagnosis, that a tumour, or even a cystic tumour, exists. The disease is usually of bacterial origin, often set up by the gonococcus, and, like endometritis,

carrying infiltration and hypertrophy in its train; yet examination of the secretion and the tissues in chronic salpingitis hardly ever shows the presence of bacteria.

With regard to purulent salpingitis with or without pyosalpinx formation, Menge's examinations and his results appear to state the whole case. His material consisted of the tubes from 122 cases of purulent salpingitis, to part of which reference has already been made. The secretion and the tissues of the tubes were examined, and cultivation experiments were carried out on a large scale. Shortly stated, the results were the following:

In 122 cases, the contents of the tubes were free from bacteria 75 times; they contained bacteria 47 times. In 28 cases, the gonococcus was found alone; in 9, the tubercle bacillus alone; once, a pyogenic staphylococcus alone; once, the colon bacillus alone; once, an anaerobic diplococcus alone. In 47 cases, then, in which bacteria were discovered, the culture was pure in 44 and mixed in 3. The presence of the gonococcus was ascertained partly by cultivation, and partly by microscopic examination, identifying the organism by the use of Gram's method.

Menge gives numerous details of anatomical changes which are of interest from other than the bacteriological point of view. One observation will be borne out by all who have had any considerable experience in the surgery of the parts, that it is impossible during operation to distinguish a pyosalpinx due to tubercle from one due to other causes. The discussion of primary and secondary tubercle of the female sexual organs in general, and of the tubes in particular, hardly belongs to the present subject. It is, however, a striking result of bacteriological examination of cases actually operated upon for tubal disease, that nearly 10 per cent were found to depend upon the tubercle bacillus alone for the anatomical and other changes which gave rise to the symptoms. The tubercle bacillus appears, therefore, to play a more important part as a parasite of the tubes than the streptococcus and staphylococcus. The *Bacterium coli commune* and the anaerobic pathogenic bacteria are still less important.

Perhaps, says Sinclair, sufficient attention has not been called to the fact that, in the great majority of cases of pyosalpinx, the secretion and tissues of the walls are found to be germ-free. This must imply that the bacteria have died out and that the pus is consequently sterile. It is to this fact, almost certainly, that we owe the comparative innocuousness of pus spilled into the pelvic cavity during operations on the pus tubes. It is probably in these obsolete cases, when no secondary invasion has taken place, that the symptom of fever does not exist. The bacteria have ceased to produce toxines. But this subject, lying between bacteriology and clinical gynecology, is still wrapped in mystery.

The relations of infections to inflammations of the tubes are demonstrable.

Infections of the Fallopian tubes result in inflammation of those structures. In the earlier classification of inflammatory diseases of the oviducts, the gross, or macroscopic appearance, of the tubal enlargements, together with their contents, was taken as the guide for nomenclature. Thus the terms hydrosalpinx and pyosalpinx signify, in the one instance a watery or dropsical, and in the other a purulent, collection within the tube, without regard to the causation or pathology of the disease.

This classification still prevails, and quite justly so, for laboratory methods have not as yet led to a more accurate or specific nosology capable of being successfully adapted to clinical diagnosis.

Without question, the classification of diseases according to their etiology would be preferable, on account of its greater scientific accuracy, but, so far, neither a careful bacteriological examination, nor microscopical sections, are sufficient to reveal the primary infecting or exciting agent in a majority of cases.

Tuberculosis is an exception to this rule, for its microscopical lesions are so characteristic as to be quite pathognomonic; but even this disease is frequently not recognised clinically at the time of operation. (See Tuberculosis of the Fallopian Tubes.) Gonococcous and streptococcous infections are likewise susceptible, although in a less definite degree, of individual study; but even these micro-organisms, while exercising a dominant and determining influence over the course of subsequent morbid events, ordinarily occur in company with other pathogenic bacteria. The closer study of the causes of inflammation in recent years, says Clark, has established the fact that it *is never* an idiopathic process, for it can not originate *de novo*. Of late, he adds, it has also been conclusively demonstrated that the mechanical and chemical causes (exclusive of bacterial toxines) seldom play a causative rôle, and that the prime factors in the production of surgical inflammations are of bacterial origin. To classify accurately inflammatory diseases according to the specific organism which produced them, would be a scientific ideal; but as this, with the exceptions already noted, is not at present practicable, the older nomenclature to which we have become accustomed through long usage should be retained, until after the discovery of more positive means by which the different varieties of inflammation, classified according to their causation, may be further distingushed from each other. Concerning the significance of names in these various conditions, there has been considerable discussion, but as this is not of great moment, for the obvious reasons just pointed out, the usual terms will be employed; when necessary, the newer terms will be indicated as synonyms in the consideration of the general morbid changes that are induced. In the present state of our knowledge, it is best to consider infections of the Fallopian tubes from (*a*) the standpoint of morbid histology, and, (*b*) as far as possible, from the standpoint of the individual infectious element.

Catarrhal Salpingitis (*Salpingitis Catarrhalis*).—Before taking up the morbid conditions of the Fallopian tubes, it may be well to recall quite briefly the essential points in their *normal anatomy*. As each tube emerges from the cornu uteri it is of exceedingly small calibre, its lumen barely admitting a fine bristle. From this point (*ostium uterinum*) it continues narrow for at least one third of its length, then gradually widens into a trumpet-shaped termination which again contracts somewhat at the abdominal opening (*ostium abdominale*). Normally, the tube runs in almost a straight course outward for half its length, then curves gently downward and dips into the pelvic cavity posteriorly to the broad ligament. Its mesentery is formed by two folds of the broad ligament within which it is situated. The three layers of the tube consist of the enveloping peritoneum, muscle (longitudinal and circular), and mucosa. As the mucosa is the portion of the tube primarily affected in endosalpingitis, the earliest stage of salpingitis, a more minute consideration of its finer histology will not be out of place.

This coat is continuous with the lining membrane of the uterus, but, unlike it, has no glands, although the depressions between the folds are so strikingly similar as to have caused Hennig, and later Bland Sutton, to describe them as true adenoid structures. The general consensus of opinion among the best histologists of the present time is against this acceptation, and the mucosa may therefore be considered as a simple nonglandular tissue. The interstitial, or uterine, portion of the tube resembles in shape the letter H, and is lined by one layer of columnar ciliated epithelium; in the extra-uterine part of the tube, the mucosa assumes a rugous appearance, being thrown up into exquisite villous or coral-like projections. The connective-tissue stroma contains delicate vascular twigs which run out at right angles from the circular blood vessels of the tube, and terminate as a rich anastomosis beneath the epithelium. As the abdominal end of the tube is approached, the mucosa is more and more thrown into duplicatures until it terminates in the fimbriated extremities. A sharp line of demarcation indicates the line of union between the mucosa and peritoneum at the tips of the fimbriæ.

Morbid Histology of Acute Salpingitis.—With this brief *résumé* of the essential points in the normal histology of the tube, we may take up, with a clearer understanding, the various inflammatory changes that occur in that structure, all of which, regardless of their mode of origin, start first as a simple salpingitis. This condition may very quickly merge into either the purulent or the hemorrhagic type, but so far as the primary pathologic phenomena are concerned, the classic signs of inflammation—*calor*, *rubor*, *dolor*, and *tumor*—are present, and accompanying them are the vascular injection, the transmigration of the leucocytes, the increase in round-celled infiltration, and the swelling of the epithelium, all characteristic histological changes in acute inflammation. In the acute stage of inflammation, the normal secre-

tion of the tube is only slightly changed. Its consistence is at first fluid, later mucoid, the colour being transparent whitish, milky, or reddish, according as it is mixed with desquamated epithelium and leucocytes or with red blood cells. One of the most striking macroscopical changes in the acute process is the marked congestion of the blood vessels, which are greatly reddened and injected and present a riblike appearance beneath the peritoneal covering of the tube. With the increase in length and thickness of the tube through these morbid changes, the tube usually becomes kinked and twisted upon itself, because the mesosalpinx maintains, without any relaxation, its normal relationship to the tubes; consequently the latter, as it becomes lengthened and enlarged, is thrown into a distorted shape. The fimbriated end of the tube, being the seat of terminal vessels, is greatly congested, of a bluish-red colour (cockscomb colour), and a stringy, glairy mucus is either seen escaping, or may be expressed from, the abdominal orifice.

From the very beginning of the inflammatory process, the secretion of the tube may assume a purulent character. Menge asserts that this is the rule in gonococcous infection, and yet Döderlein, to a certain extent, negatives this statement by the report of a case of double gonorrhœal tubal inflammation in which myriads of gonococci were found; on one side there was a pyosalpinx, while on the other, only a simple tubal catarrh had occurred.

The mucosa is greatly increased in thickness, both on account of the hypertrophy of its constituent cells, and because of the vascular congestion of the villi. At this stage, a transverse section of the tube presents a rosettelike appearance, the mucosa projecting rather prominently over the peritoneal edges. In the acute stage of the inflammation, the morbid changes may be confined entirely to the epithelial lining, and the immediately underlying connective-tissue stroma, whence the term endosalpingitis.

So long as the inflammatory condition is strictly limited to the mucosa, the outward appearance of the tube, with the exception of the vascular injection and reddening, presents no other changes. Indeed, in the acute stage, especially when there is no increase in the tubal secretion, the appearances are strikingly like those of the tube in its period of normal congestion during the menstrual flux.

Notwithstanding a considerable increase in the secretion of the tube, due to the local irritation of the infectious agent, the tubal epithelium remains intact much more frequently than would be supposed. The underlying connective-tissue stroma, and not the epithelium, is the chief seat of the initial inflammatory changes in acute catarrhal salpingitis.

On section, the mucous membrane presents many folds and duplicatures which form, through contact of their free ends, baylike or loculate spaces. The stroma cells are much richer in nuclei and the blood vessels are greatly widened, and show considerable transmigration of polynuclear leucocytes.

Throughout the stroma, in a section by Whitacre, a variable amount of round-celled infiltration with beginning suppuration is observed (Fig. 210), depending upon the nature and activity of the local infection. In isolated areas, minute extravasations of blood are seen. Notwithstanding a local irritation sufficient to incite these changes, the epithelial layer usually remains intact and does not even shed its

Fig. 210.—"Throughout the stroma, in a section by Whitacre, a variable amount of round-celled infiltration with beginning suppuration is observed."—Clark.

cilia, although the cells appear congested and swollen. From this stage on, the course and termination of the inflammation depends upon a number of conditions, such as the variety of infectious organisms, the strength of their virulence, and the local resistance of the tissue. Thus, there is occasionally observed a loss of the epithelium and complete replacement of the mucosa by a cylinder of pus cells (Fig. 211).

If resolution does not occur in the acute stage before detailed, the inflammatory process tends to become chronic, when the extent and general characteristics of the pathologic lesions may become most diversified.

Morbid Histology of Chronic Salpingitis (*Salpingitis chronica*).—With the continued action of the irritating agent, be it the primary infectious micro-organism or the toxines generated by it, the acute inflammatory stage merges into a chronic condition, and a marked

involvement of the muscular portion of the tube occurs. The serpentine course of the tube becomes more pronounced and sharp twists and kinks result. The tube assumes a more bluish or congested appearance, and many vessels, which previously appeared as capillaries, become quite prominent. Through the sharp kinking of the tube, micro-

Fig. 211 (Whitacre).—"Thus, there is occasionally observed a loss of the epithelium and complete replacement of the mucosa by a cylinder of pus cells."—Clark (page 491).

scopical sections not infrequently show two or more views of the tubal lumen, cut transversely or obliquely. As in all chronic inflammations, there is an excessive formation of new connective tissue, which renders the tube stiffer and much less flexible than normal.

The extravasations of blood, which are microscopical in the acute stage, may frequently become so marked as to be visible to the naked eye as bluish-red spots. Through hypertrophy and hyperplasia of the connective tissue and muscular portions of the tube, its wall may reach a thickness of 2 centimetres, or even more, in long-standing cases, as a result of the continuous irritation and destruction of the tubal epithelium; the club-ended villous projections of the mucosa adhere together, which not only decreases the primitive lumen of the tube, but gives it, even on macroscopical examination, a loculate appearance. Notwithstanding the fact that this condition appears most frequently in the isthmiac portion of the tube, a complete atresia seldom occurs. For instance, Reymond found it only once in 94 cases.

Sooner or later in the course of the chronic process, plastic lymph is thrown out about the tube, which organizes and forms adhesions of varying density between the angles of the distorted tube, and between the tube and neighbouring viscera. The most frequent and important changes effected by these adhesions is the closure of the fimbriated end of the tube (see Hydrosalpinx and Pyosalpinx). In the course of this atretic process, the abdominal end of the tube may gradually be narrowed until an opening not larger than a robin's quill remains. Through this gradual narrowing, the secretions may be more or less hemmed in, with now and then an intermittent discharge into the pelvis, giving rise in some cases to an extensive pelvic peritonitis.

The narrowing of the ostium abdominale may occur, either through the gradual adhesions of the peritoneal edges of the fimbriæ, or, as is not infrequently, but in fact, is usually, the case, the fimbriæ become invaginated within the tube, and are then incarcerated.

The small round-celled infiltration which at times occurs beneath the mucosa in the acute stage becomes generalized in the chronic process, until, as seen in a section by Whitacre, the entire tubal wall may become involved (Fig. 212). From delicate villous termini the folds of the mucosa are transformed into rounded fusiform ends filling up the lumen of the tube and lying in close contact with each other. On account of this contact the epithelium becomes destroyed, and the projections adhere together and establish isolated loculi or diverticula. These spaces may be gradually obliterated through a typical granulation process, or the epithelium may remain intact, and, through the accumulation of a catarrhal secretion, be transformed into larger cystic cavities; or from a ciliated cylindrical type the epithelium may undergo retrograde change until it assumes a flattened or endothelial-like appearance.

Through the projection of the fusiform villi into the tubal lumen, adhesions may take place between opposing ends and thus establish connective tissue bridges from one part of the tube to another. The occurrence of the glandlike space has further strengthened Hennig and Bland Sutton in their belief in the true adenoid nature of these structures. As stated in preceding pages, this theory has found but few supporters, for the adventitious way in which these spaces are formed becomes too manifest on critical examination.

In view of the fact that these spaces are the unmistakable products of a pathologic process, Martin prefers the term *salpingitis pseudofollicularis* to *salpingitis follicularis* as employed by some writers. In the chronic stage the tubal secretion may vary, just as in the acute form, from a transparent catarrhal to a purulent character.

Upon the nature of the secretion depends the nomenclature. The usual terms employed in describing the varieties of chronic salpingitis are catarrhal, hemorrhagic, and purulent.

The *hemorrhagic salpingitis* (*Salpingitis hæmorrhagica*), so far as its histologic characteristics are concerned, presents no essential variation

from the foregoing description further than that induced through the deposition of blood pigment in the areas of extravasation and upon the inner walls of the tube.

The tubal secretion is of a reddish or chocolate-brown colour, due to its mixture with red blood corpuscles in various stages of disintegra-

Fig. 212.—"The small round-celled infiltration which at times occurs beneath the mucosa in the acute stage becomes generalized in the chronic process, until, as seen in a section by Whitacre, the entire tubal wall may become involved."—Clark (page 493).

tion. Polynuclear leucocytes crowded with blood pigment are seen in various parts of the tissues, and are especially numerous around the ecchymotic areas.

In *chronic purulent salpingitis* the tubal secretion consists largely of pus, varying in appearance from a flocculent sero-purulent character to a thick yellowish or greenish colour. If, as a result of a severe infection, purulent salpingitis sets in at the very beginning without an appreciable catarrhal change, the local inflammatory changes be-

come most pronounced, consisting in an excessive transmigration of leucocytes, a rapid round-celled infiltration, and a rapidly increasing œdema of the mucosa. Through these hypertrophic changes, the tube assumes a size much greater than the normal. Martin has attempted to establish a differentiation through microscopic examination between the acute septic salpingitis and the acute gonorrhœal salpingitis.

According to our view, unless the infectious micro-organism is recognised either through cultures or through cover-glass preparations, we do not believe this differentiation through a simple histological examination is possible except in the hands of an expert microscopist, and even then the results must be viewed with considerable scepticism.

Through the closure of the ostium abdominale, the tube becomes more or less distended, and, according to the nature of its secretion, is called a hydrosalpinx, hematosalpinx, or pyosalpinx.

Hydrosalpinx (*Hydrops tubarum*, *Sactosalpinx*) is a pathologic collection of serous fluid within the Fallopian tube due to a partial or complete stricture in some part of the tube.

While a pathologic atresia may occur at any point in the tube, the usual seat is at the fimbriated end. In rare cases, more than one stricture may take place, which divides a simple hydrosalpinx into two or more chambers.

According to Rokitansky, the occlusion of the fimbriated end is due to the adhesion of the peritoneal surfaces of the fimbriæ, which become inverted within the tube. Klob offers a similar explanation and attributes the adhesions to a tubal catarrh, perisalpingitis, or pelviperitonitis.

According to Klebs, atrophy of the fimbriæ may result from a localized inflammation leading to an inversion of the fimbriæ and a filling in of the ostium abdominale with scar tissue. While these strictures of the tube may result, in rare instances, from other than inflammatory causes, as, for instance, the dropsical accumulation in the tube in certain cases of myoma, nevertheless, the chief inciting factor is undoubtedly a perisalpingitis. Whether the inflammatory condition is always of bacterial origin, is as yet an open question. Menge and others have, for instance, described numerous cases in which the occlusion occurred through a sterile process, such as the chemical irritation of hemorrhagic accumulations, and from the mechanical congestion due to the pressure of tumours, etc. These cases, however, are comparatively rare, and, as a rule, the first cause may be accepted as the chief one.

While it is generally conceded that hydrosalpinx is *sui generis* a dropsical accumulation, yet such eminent authorities as Zweifel and Bland Sutton believe that it may result from the resolution of a pyosalpinx, the purulent matter undergoing a transformation into an aqueous accumulation.

Menge, Kleinhaus, and others, as the result of careful observation, state with positive assurance that such a retrograde metamorphosis is not possible, for they say that, although pus may become thick and

inspissated, it never undergoes liquefaction, and also that the histological changes in hydrosalpinx are radically different from those observed in pyosalpinx. Upon the basis of Clark's observations an unqualified support to the latter opinion may be given.

As a general rule, hydrosalpinx is attributable to puerperal rather than to gonorrhœal infection. Menge, for instance, holds very strongly to the belief that the gonococcus is a pus-producer, that, consequently, a purulent salpingitis or pyosalpinx is usually produced by it, and that only in rare instances does hydrosalpinx result from this micro-organism, and then only as a secondary process. In explaining the latter statement, he says that the primary gonorrhœal salpingitis may have reached its climax and be undergoing resolution when, as a result of a secondary pelvic peritonitis, the ostium abdominale may become occluded with a simple hydrosalpinx as a sequel.

Von Rosthorn maintains with forcible argument that hydrosalpinx is always induced by a pelvic peritonitis. He says that streptococci or staphylococci gain entrance to the tube, and, because of attenuated virulence, only a simple catarrhal salpingitis is inaugurated, and that later, through continuity of structure, the pelvic peritoneum becomes involved and the tube is thus sealed by adhesions. Coincidently with this occlusion, the secretion of the tube begins to accumulate, first distending the abdominal end, then progressively extending toward the isthmiac, or uterine, extremity of the tube. Quite naturally the distortion decreases toward the uterus on account of the greater resistance offered by the tube.

The escape of fluid is prevented or greatly retarded through adhesions, organic occlusion, mechanical torsion, or kinks at the uterine juncture of the tube. As stated under the head of Salpingitis, an actual closure of the lumen of the isthmiac portion of the tube through inflammatory changes is comparatively rare. With the increase in the accumulation of fluid within the tube, its wall undergoes a gradual thinning, and, although a marked pressure atrophy may ultimately take place, the visible landmarks of the longitudinal folds of the mucosa will appear as ridges running direct from the vestibular to the isthmiac extremity of the tube.

Upon the degree of distention depends the variation in the morphology, the size ranging from that of a lead pencil, with more or less conformation to the normal undulations of the tube, to a very large fusiform tumour with a smooth glistening exterior. As the tube is gradually transformed from its normal shape it may assume a sausagelike, serpentine, or what is more usual, a retort or pipe shape. In rare instances, the tube may reach very large dimensions, and the morphologic characteristics may be so obscured as to render its identification very difficult on account of the close resemblance to a tubo-ovarian, ovarian, or parovarian cyst. Even in cases of moderate distention, the muscular and connective-tissue layers may become so attenuated as to allow the contents of the tube to be seen through its transparent wall.

The tubal secretion may be of a clear limpid, a yellowish lemon, or a slightly blood-tinged colour, and its formed elements may consist of leucocytes, epithelium, red blood cells, and sometimes cholesterine crystals. To the latter, Bland Sutton ascribes the greenish colour occasionally noted in the fluid.

With the progressive increase in the size of the tube, the mucosa loses its coral-like or villous appearance, becomes greatly stretched, and may undergo such complete atrophy as to leave only the small ridges before described, or, as is seen in some cases only, small blunt teatlike eminences.

Of the mucosa the epithelium alone remains, and this is usually transformed into a cuboidal or flattened variety; in the deep angles and protected areas it may, however, still maintain its cylindrical character, and even the cilia may remain intact.

As a unique and rare production, bonelike or calcareous plates are found in the walls of the tubes, or, as illustrated by Cullen's case, the tube may contain a calculus.

Hydrosalpinx does not, as a rule, reach a large size, although cases are reported in which the contents measured a litre or more.

With regard to the comparative frequency of single or double hydrosalpinx, it is usually stated that the double form is the more common. To the contrary, however, Cullen states that in a series of 27 cases, he found 17 unilateral while the remainder were bilateral.

Types of Hydrosalpinx.—Certain deviations in morphology from the simple form just described constitute special types of hydrosalpinx. Occlusion of the tube in salpingitis pseudofollicularis, with its subsequent enlargement, constitutes hydrosalpinx pseudofollicularis. In this condition the tube rarely reaches such a large size as the simple form, from purely mechanical reasons, for it is self-evident that a cavity divided into numerous loculi can not distend, on account of increased resistance, with the same facility as a unilocular cavity.

Cross sections of the tube present a spongelike or irregular punched-out appearance, the larger cavities being lined with cuboidal, the smaller with simple cylindrical or ciliated epithelium. In some spaces, desquamated epithelia are seen.

As a special variety, named, not because of its histological deviation from the simple variety, but on account of its intermittent discharge of fluid into the uterus, is the *hydrops tubæ profluens*. In these cases the tube may reach a very large size before the sphincterlike action at the uterine cornu is overcome, when a profuse serous flux is noticed by the patient. This is a comparatively rare condition, only isolated instances having been reported from even the largest clinics.

This peculiar intermittent action of the tube is attributed to several causes. According to Landau, the muscular walls at the uterine juncture are greatly hypertrophied, and only when this constriction is overcome by the *vis a tergo* of the serous accumulation is the periodical flow inaugurated.

Other investigators have attributed this condition to a stricture of the tube which, like the kinked garden hose, is only overcome by the gradual increase in pressure behind the point of constriction.

The last variety of hydrosalpinx, known as *tubo-ovarian cyst* (Fig. 213), is a pathologic condition in which the hydrops tubæ is associated, by organic union, with a cystic condition of the ovary, the fluid from one cavity mingling with that of the other.

These aqueous tumours vary from a very small to a very large size, reaching in some instances a diameter equivalent to that of a child's head. With a free communication between two secreting cavities, such as one finds in these cases, it is quite natural for the cystic tumour to reach much larger dimensions than the simple hydrosalpinx.

The Fallopian tube is situated upon the upper surface of the tumour and usually appears as a large club-shaped or retort-shaped body, which

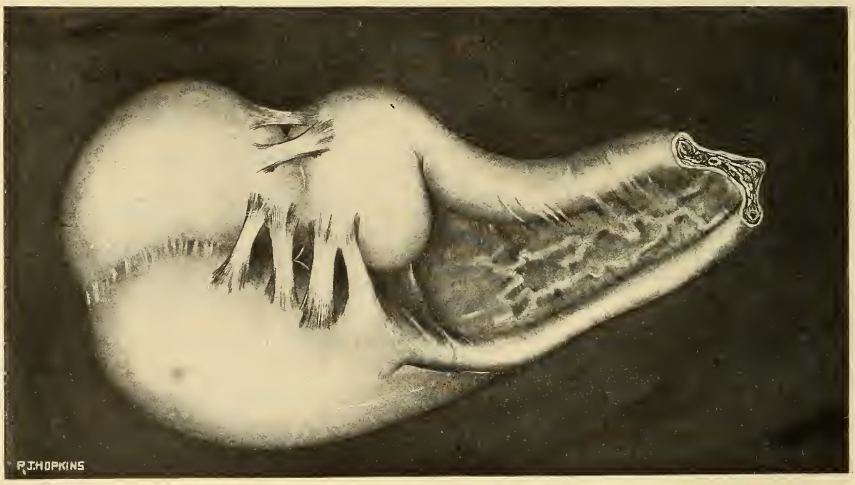

Fig. 213.—"The variety of hydrosalpinx known as tubo-ovarian cyst."—Clark.

is fused at its fimbriated extremity onto the surface of the ovary by adhesions of more or less density, depending upon the chronicity of the inflammatory process.

The communication between the cystic portion of the ovary and the tube may be established, either by the primary adhesion of the spread-out fimbriæ upon the surface of the cyst with a subsequent rupture into the tube, or the free fimbriæ may become incarcerated within the ruptured opening of a cystic Graafian follicle or other ovarian cyst. In general appearance, the tubal portion of this combined tumour does not differ from the usual hydrosalpinx, while the ovarian portion conforms to the usual classification of the simple unilocular, multilocular, or glandular cysts.

Where the adhesions are quite dense and the tube and ovary are fused together in a very close organic mass, it may be difficult or

impossible to recognise macroscopically the loculi which originate in the ovary from those of the tube. In such instances, however, a distinction may be made microscopically, through the recognition of the characteristic ovarian stroma and constituent cells of the Graafian follicle.

Hematosalpinx (*Sactosalpinx hæmorrhagica*) is a collection of blood within an occluded tube, similar to the serous collection in a hydrosalpinx. Until quite recently all hemorrhagic tubal collections have been placed under this classification. Veit, however, has shown that this is an error, as the hemorrhage incident to a tubal pregnancy or to a malignant growth is merely an accidental product, and should, therefore, not be given this misleading name.

Hematosalpinx is produced through sharp kinks and torsion of the tube, thrombosis of the tubal vessels, and from simple hemorrhage into a hydrosalpinx.

Less common causes are acquired or congenital atresia of the uterus or vagina, traumatisms of the inner genitalia, and the injuries of severe labours. Although the majority of cases may be attributed to some one of these easily recognised causes, there is still a considerable number of cases in which the minutest history and most painstaking physical and microscopic examinations have failed to reveal the true etiology. Martin ascribes some cases to vicarious menstruation, while others attribute this condition to a reflux of menstrual blood from sudden spastic uterine contractions. Sänger asserts that an aseptic accumulation of blood in the pelvis may induce a localized peritonitis, through which the abdominal ostium becomes occluded while the tubal hemorrhage is still in action. The pathologic changes observed in these cases depend upon the primary cause of the hematosalpinx. When the intratubal hemorrhage is induced through a strangulation of the tube, the vessels are thrombosed and numerous areas of extravasation within the tubal wall are found, and in some instances large infarctions may occur.

The tissues always stain badly and microscopical sections frequently show very much obscured histologic characteristics. More or less extensive hemorrhagic necroses frequently take place, but are sharply limited by the line of strangulation.

In the simple cases where the blood is either shed from the mucosa into a hydrosalpinx, or where it reaches the tube as a reflux from the uterus, the histologic picture presents no essential structural deviations from those observed in hydrosalpinx. The inner wall of the tube is covered with a pigmentary deposit and the mucosa may be the seat of minute capillary extravasations. Leucocytes laden with blood pigment are also found within the vessels and as wandering cells in the tissues.

Pyosalpinx (*Sactosalpinx purulenta; suppuration of the tube*) is a purulent collection within the Fallopian tube, which arises as a result of occlusion in some part, usually at the ostium abdominale, of an in-

flamed tube. Quite naturally, an agent sufficient to induce this secretion of pus is of a more irritant nature than that found in a simple catarrhal process, consequently the inflammatory reaction is usually much more marked. The extent of the involvement is variable, and the size of the tube and the thickness of its walls depend upon the degree of distention. When the quantity of pus is small, the tubal walls are usually greatly swollen and the thickness may exceed the normal many fold, whereas in a large tense pyosalpinx the opposite condition may be noted, just as in a hydrosalpinx. So far as size is concerned, a pyosalpinx as a rule does not reach that of a hydrosalpinx, although instances are recorded in which an enormous abscess has developed.

Upon the intensity and chronicity of the inflammatory process also depends the appearance and character of the pyosalpinx, for with the long persistence of the infection there is a steady increase in the amount of connective tissue, which transforms the tube from a flexible to a stiff resistant condition. Notwithstanding the presence of a very irritating infectious matter the lining epithelium may remain intact a surprisingly long time; but sooner or later it is completely destroyed in those areas exposed to the contact of the pus, and is supplanted by granulation tissue.

As a result of the direct extension of the inflammation through the wall of the tube or from local infection of the enveloping peritoneum by escape of the pus from the ostium abdominale, the tube is usually covered with adhesions which bind it to the neighbouring organs. The organization of the adhesions often binds the ovary into an indistinguishable mass with the tube, and in such cases abscesses often form in the spaces between these organs, or between the intestines and tube (perisalpingeal abscess), thus converting the mass into multiple suppurating loculi.

Just as the tubo-ovarian cyst, described in preceding pages, is formed, so may these cases be converted into tubo-ovarian abscesses. The ovary, however, notwithstanding its close proximity to the tube, is very often free from infection, there being only a simple perioöphoritis which does not penetrate beyond the tunica albuginea.

The contents of a pyosalpinx vary in consistence from a thin yellowish purulent fluid to a thick inspissated cheesy matter, consisting of disorganized pus corpuscles and red blood cells, fibrin, degenerated epithelium, and granular detritus.

As a rule the culture and microscopic evidence of micro-organisms give negative results.

In the earlier stages of the pyosalpinx, granulation tissues may take the place of the mucosa and the underlying tissue become richly infiltrated with round cells; later, however, the granulations are transformed into dense scar tissue and ordinary connective tissue. As the inflammatory process becomes chronic, the muscular tissue undergoes marked atrophy until mere traces only may remain. The vessels be-

neath the peritoneum become thick and tortuous, and sooner or later show hyaline degeneration. In some cases the tubal wall may become quite œdematous. Even in simple cases, isolated spaces, like those in salpingitis pseudofollicularis, are seen, which are lined by granulation or scar tissue and contain pus. When a typical case of salpingitis pseudofollicularis is converted into a pyosalpinx, cross sections of the tube show an exaggerated loculated appearance. As a result of simple inflammation or from the deposition of lymph which undergoes organization, the peritoneum may become very greatly thickened.

Symptoms and Diagnosis of Salpingitis.—Although we may have a morbid process strictly confined to the tube—a salpingitis—we much more frequently find that other tissues have been implicated at the same time. More especially is this true of the pelvic peritoneum; and in many cases, therefore, the symptoms of a salpingitis are largely modified by the virulence and extent of the accompanying peritonitis.

General Considerations.—The symptoms of inflammation of the uterine appendages and the pelvic peritoneum vary with the extent and character of the infection. The less virulent the infecting agent, and the greater the resisting power of the various anatomic structures it encounters, the more limited is the extent of the morbid process and the less severe its general and local effects upon the organism.

In primary tubal infections, Nature often prevents the direct extension to the other pelvic tissues by sealing the fimbriated end of the tube. It is true that the morbid process sometimes, though very seldom, makes its way through the walls of the tube, but in such cases the battle is prolonged, and the resistance being greater, the other tissues of the pelvic cavity are only implicated to a limited extent. When the inflammation has been only just severe enough to seal up the fimbriated extremity of the tube, the mucous membrane may be left in a practically unaltered condition, but the normal secretion being poured out dilates the cavity. If this condition is speedily relieved by the escape of the exudate into the pelvic cavity or into the uterus, the symptoms, so far as the tube itself is concerned, may be imperceptible. But since the tube is much less sensitive to pain than the uterus and ovaries, even when the exudate is localized and retained in it, but little disturbance may be caused. For this reason the milder catarrhal inflammations, even when acute, may cause symptoms too slight to fix the patient's attention definitely upon the diseased part. They may, indeed, run their course and disappear without ever having been recognised, leaving behind hardly any perceptible trace. So frequently do these processes escape notice, that it may be said that in an acute or chronic catarrhal salpingitis the symptoms are seldom of a prominence sufficient to give rise to the suspicion that any disease is present.

In the cases which present symptoms there is more or less localized pain or discomfort, the nature and intensity of which varies within wide limits. Thus, sometimes the patient complains rather of a dull

aching or burning sensation, which only becomes a real pain when she moves about or goes up or down steps, or when local pressure upon the parts is exerted by walking, defecation, or the various manipulations of the examining physician. And yet, despite this, the tube may be distended and almost ready to burst (Fig. 220).

In the so-called *colica scortorum* the attack is characterized from the beginning by sharp colicky pains in the region of the tubes. These come on in paroxysms, while in the intervals the patient enjoys comparative comfort. This intercurrent pain is considered by Schauta to be characteristic of salpingitis isthmiaca nodosa. In other cases, as has been said, the intense pain points rather to extension of the process to the peritoneum or the ovaries.

To a large extent the sufferings of the patient are due to mechanical causes. It can be readily seen that greatly dilated and swollen tubes, especially when the filling up has been rapid and the tissues have not had time to adapt themselves to the stretching, might give rise to intense pain, particularly if the pelvic tissues around are inflamed and sore. Hence the mechanical symptoms may be numerous. The pressure or dragging upon the different tissues may give rise to painful defecation and micturition, difficulty and pain on standing or moving about, together with pressure neuralgias and symptoms referred to the digestive tract or the cerebro-spinal system, all of which may be reflex in origin. At the time of menstruation, the congestion of the ovary, which is often bound down together with the tube by firm adhesions, resisting its expansion, doubtless accounts for not a little of the pain. The great possible variety and intensity of these mechanical disturbances should always be kept in mind. Though, as a rule, it may be said that marked aggravation of the symptoms with nausea, fever, abdominal distention, tenderness, drawing up the thighs, and a pinched expression of the face, point to the development of a general peritonitis, we may sometimes at operation be agreeably surprised to find that the inflammation is localized to one or more parts of the peritoneum, and that the mechanical factors of pressure or traction have been sufficient to give rise to indications of the existence of the more alarming condition.

During the monthly period the pathologic congestion is increased, so that dysmenorrhœa is common. In most cases of tubal disease there is usually an increase, rather than a decrease, in the menstrual flow, and even menorrhagia may be present. Absent or scanty menstruation should make us suspect tuberculosis. Sterility is a common symptom in tubal disease, and is due, either to mechanical obstruction to the passage of the ovum or spermatozoa, or to the distinctive influence exercised upon them by the poisonous material which they encounter in the tube.

In a large number, one might say in the majority, of cases of pelvic disease, a satisfactory diagnosis can only be arrived at after an examination under anæsthesia. The relaxation of the abdominal muscles en-

ables us to examine more thoroughly, and at the same time does away with the necessity of using any violence. Hence the safety of the patient is secured, as well as the means of making a more satisfactory diagnosis. A thorough evacuation of the bowels and of the bladder should always be provided for. Combined internal and external palpation is necessary. The right hand being placed over the hypogastrium assists the left index finger in the vagina; or the index finger may be inserted into the rectum and the thumb into the vagina. In cases of adnexal disease it will generally be possible to make out on one or both sides a mass, which in most cases proves to be the inflamed tube, or this together with other structures implicated, according to the character or extent of the process. To decide as to the nature and limits of the various component parts of the mass is often difficult or even impossible. Again, there are quite a number of conditions which may be confused with adnexal inflammation, the principal of these being:

1. Tumours of the uterus, tubes, broad ligaments, intestines, sacrum, and ilium.
2. Appendicitis.
3. Intestinal adhesions.
4. Fæcal accumulations.
5. Extra-uterine pregnancies.
6. Uterine displacements.
7. Parametritis.
8. In rare cases a displaced kidney, spleen, or other abdominal viscus, may simulate a pathologic condition of the adnexa.

A *myoma* developing lateralward from the uterus may simulate in form and location a sactosalpinx. As a rule, however, the former, being more closely incorporated with the uterus, causes an enlargement of the body. Myomata develop gradually, are frequently painless, and are characterized by more profuse menorrhagia than is common in tubal disease. Again, while the symptoms due to pressure are more marked, those indicative of inflammation are absent in uncomplicated myomata.

In *neoplasms* of the tubes and broad ligaments, we have an absence of a history and of symptoms of infection. Again, new growths are less painful, of slower development than the masses resulting from adnexal inflammations, and at the same time they are not so likely to produce adhesions so early. Only when such do not exist, will the recognition of the masses as distinct from the adnexa be possible and render the diagnosis certain.

Ovarian tumours are often distinguished from instances of sactosalpinx only by means of an exploratory incision. The following points of distinction, however, should always be remembered: A tumour of the ovary is more likely to assume a somewhat globular shape, while a sactosalpinx is rather elongated. Again, the sactosalpinx can often be made out to be nearer the uterus, and if the ovary can be isolated in addition to a tumour between it and the corpus, the diagnosis is ren-

dered comparatively easy. Large ovarian tumours can be distinguished by their size, but in the case of small parovarian or ovarian cysts and solid tumours, when the course of the tube can not be followed from the uterus to the ovary, a diagnosis is usually impossible. Sometimes a distended tube may be felt above the brim of the pelvis and may simulate very closely a suppurating ovarian cystoma. Here, the history and examination give us no help toward a diagnosis.

Appendicitis.—When there exists no tubal disease, the history and symptoms coupled with the physical examination will aid us in making our diagnosis. Again, the pain of an appendicitis is more often localized, or at any rate has a maximum intensity, over McBurney's point, while that of adnexal disease is most prominent lower down, in what is known as the ovarian region.

When, however, an appendicitis, as happens not infrequently, complicates a salpingitis, a diagnosis of the former condition is generally made only at operation.

Intestinal adhesions and *intestinal obstruction* from pelvic inflammation, except when a loop of intestine is adherent to the tubes or broad ligaments, can generally be made out by physical examination, especially when the tubes are not implicated. In intestinal obstruction, the onset is generally more sudden, and the symptoms on the part of the bowels are suggestive.

Fæcal accumulations in the rectum can be made out with the examining finger.

Extra-uterine pregnancy has usually begun in the tube, and we may therefore feel what appears to be an inflammatory sactosalpinx. Here, however, we have a history and certain symptoms pointing to pregnancy. Enlargement of both tubes excludes an ectopic pregnancy except in those very rare instances in which we have a sactosalpinx on one side and a tubal pregnancy on the other.

Uterine displacements may frequently lead to confusion. A displaced corpus uteri may often simulate an inflammatory mass, but the recognition by means of conjoined palpation and, when necessary, the use of the sound, will seldom fail to guide us to a correct diagnosis.

The diagnosis of *parametritis* and its relation to adnexal disease have been discussed in another place.

Hematoma.—Here the history will aid us. With a large flow of blood into the pelvic cavity from rupture of a tubal gestation or other cause, we have generally acute pain, without signs of inflammation, but with those of more or less severe internal hemorrhage. Only when the hematoma has become infected, will signs of pelvic abscess appear.

Finally, it may be said that, even after we have arrived at a diagnosis of adnexal disease, it will often be impossible to decide absolutely whether the tube or ovary or both are implicated. Nor shall we always be able to say before operation, in the case of tubal disease, the exact condition which exists, or to arrive at the etiological factor,

until a bacteriological examination has decided the matter. Suggestive information can often be obtained from examination of the vaginal discharge.

Having referred to the symptoms and diagnosis of disease of the adnexa in general, it will be well to take up the different forms of salpingitis separately and give somewhat more in detail their distinctive characteristics.

Hydrosalpinx.—When the inflammation has been only sufficient to glue the fimbriæ together, it is quite possible for the tube to be distended with a serous exudate (the natural secretion which is now pent up) without giving rise to any symptoms, unless indeed the resulting tumour should be of a size sufficient to cause mechanical disturbances. But the distended portion of the tube hardly ever exceeds the size of an average orange, and the neighbouring parts easily accommodate themselves to their slight change in position, especially if it comes about gradually. When the process has invaded the serous membrane with more virulence, we have, as might be expected, a degree of pain corresponding to the grade of inflammation and the number and extent of the adhesions.

Leucorrhœal discharges are common in the majority of pathologic conditions affecting the uterus or the adnexa. In a pure catarrhal condition confined to the tube, the discharge is generally of a whitish character. A muco-purulent discharge points rather to inflammation of the endometrial lining of the uterine cavity, and is not caused by a localized peritonitis. The presence of an endometritis more probably indicates a possible purulent salpingitis than a hydrosalpinx.

As generally happens in any case of pelvic inflammation, menstrual disturbance is often present in hydrosalpinx; the flow is generally too frequent and is increased in quantity.

In hydrosalpinx, constitutional symptoms may be entirely absent. The temperature is normal or only slightly elevated, the patient may have a good appetite and may feel well. She may be able to perform her daily duties and live in comfort. At other times, however, exertion may bring on pain in the pelvic region on one side or on both.

Diagnosis.—It would seem that a diagnosis of hydrosalpinx should be easily made after a careful physical examination. As a matter of fact, this is true in some cases. When we find a kidney-shaped tumour, generally unilateral, in the position normally occupied by the Fallopian tube and near the ovary, we may feel quite certain that we have to deal with a salpingitis. Again, since the tube is normally divided into compartments, when we find this sausage-shaped tumour sacculated, we may conjecture with great probability that we have a tube which is distended with fluid, whether it be serum or blood, and consequently we may make a diagnosis of hydrosalpinx or hematosalpinx. And yet, even after we have decided that the tumour present is part of a distended tube, we shall often remain in doubt as to the exact character of its contents. As a rule, however, in hydrosalpinx

the walls of the tumour are thin and the mass gives to the finger a sense of elasticity, the degree of which is largely dependent upon the size of the growth and the consequent thinness of the walls. The lack of adhesions is always an important factor, and mobility of the tumour is more characteristic of a hydrosalpinx than of a pyosalpinx. When, however, the tube is greatly distended, the tumour takes on a rounded form and resembles more an ovarian cyst.

The other principal conditions liable to be confused with a hydrosalpinx are small ovarian or parovarian cysts, hematosalpinx, and extrauterine pregnancy. A typical hydrosalpinx is movable, sausage-like, or reniform in shape, and its course can be followed, as it comes off from the uterus, in the position occupied normally by the tube. The ovarian tumour or cyst is rounded and separated from the body of the uterus. A parovarian cyst may be movable, but it is more usually of a rounded than of an elongated form.

Extra-uterine pregnancy is distinguished by the history and by various signs pointing to pregnancy. Again, as has been said, salpingitis causes dysmenorrhœa more often than amenorrhœa; and the latter, together with enlargement of the breasts and other more or less definite symptoms, should always suggest a possible ectopic pregnancy. Later, rupture with the classic symptoms of internal hemorrhage makes the latter diagnosis certain. With respect to the diagnosis between hydrosalpinx, hematosalpinx, and pyosalpinx, more will be said later.

Hematosalpinx.—Here, instead of a serous fluid, we have a sactosalpinx containing blood. As a rule, the symptomatology and physical signs are much the same in both conditions. The tumour is in the same position and of the same shape as a hydrosalpinx.

Hematosalpinx, except as a result of tubal pregnancy, is simply a hydrosalpinx into which a hemorrhage has occurred, and naturally therefore in its simple form is a rarer condition than hydrosalpinx. Various tables are found in text-books showing the important distinguishing points. But, when all has been said, the fact remains that as a rule neither the history nor the symptomatology affords a sufficient basis for a positive diagnosis between these two closely allied conditions.

Pyosalpinx.—When a purulent focus exists in either one or both tubes the process often extends to the ovaries or the pelvic peritoneum. The symptoms vary according to the intensity and extent of the infective process. In the acute stage, which lasts a week or more, the pain is intense. The patient lies in bed with the knees drawn up and looks and feels very ill. The pain complained of is sometimes localized, but it must be remembered that, without any general peritonitis the pain and tenderness may be diffuse and may be referred over the whole abdominal region.

The temperature ranges from 100° to 105° F.; the pulse is rapid, 100 to 120; when pus is present, the patient frequently complains of chills or chilly feelings, and she may also suffer from sweats. The abdomen is tense and tender, sometimes sufficiently so to suggest the

presence of a general peritonitis, although in reality the process may be more or less strictly localized.

In favourable cases, after a few days the temperature becomes lower, although it may still be one or two degrees above normal with remissions. The pulse rate remains slightly above the normal. In such cases the patient may often be able to get about, but every now and then she will have a setback and suffer for a few days from high fever and pain, after which the temperature falls again. These relapses are probably due to the escape of a small amount of pus from the abscess with a resulting peritonitis. When a large abscess ruptures suddenly a general peritonitis may be set up, and unless prompt operative intervention occurs, the result is likely to be fatal.

This recurrence of attacks may go on for years. The patient is never well, and at intervals is dangerously ill. Such cases have often been cured by removal of the pus sacs.

In cases of gonorrhœal salpingitis, we can often obtain a history of a sudden attack of vulvitis or vaginitis which has sooner or later been followed by abdominal pain. It may, however, be difficult to obtain so direct a history from the patient, as it may be months or years before she comes to us with symptoms referable to the tubes or pelvic peritoneum. Many patients give no history of gonorrhœa, but they may complain that they have been suffering for some weeks or months from pain in the lower part of the abdomen with, perhaps, painful micturition and defecation. They may also tell us that they think they have had fever, and that at intervals they have had chilly sensations or definite rigors. Despite the length of their illness, however, we may find them with fair appetites, little or no fever, and, generally speaking, in excellent condition except for the local symptoms.

A streptococcous infection generally dates from a labour, an abortion, or local treatment. It is usually ushered in with a chill and the fever rises rapidly. This continues for some days, and the pinched look and anxious expression of the patient show very visibly the effects of the absorption of septic material. Abdominal tenderness and distention are marked. After the acute stage has passed, the patient may get out of bed, but she usually still has a septic temperature and hardly ever attains the relative health of the gonorrhœal cases.

Obstinate constipation is sometimes present, usually because the patients fear to have a stool on account of the severe pains that are excited by the efforts. Occasionally partial or complete obstruction is caused by bands of inflammatory tissue stretched across and confining the lumen of the bowel (Fig. 214).

Painful micturition is not likely to be present when the purulent process is confined to the tube; often, however, the bladder is pressed upon by the inflammatory mass or becomes infected with the specific poison (Fig. 215). In the most favourable cases, if not submitted to operation, weeks or months elapse before the poison has worn itself

out. Only in rare instances does the patient regain complete health, and then, as a rule, only after months of suffering and inconvenience.

After the disease has become subacute, the symptoms, though less severe, are still present, and exacerbations may occur from time to time. A persistent suppurative process in the tube or in the pelvic peritoneum gives rise to various pains, especially to a bearing-down feeling, headache, backache, often to a chronic purulent discharge, and sometimes to painful micturition and defecation. A gonococcous infection often wears itself out in this way.

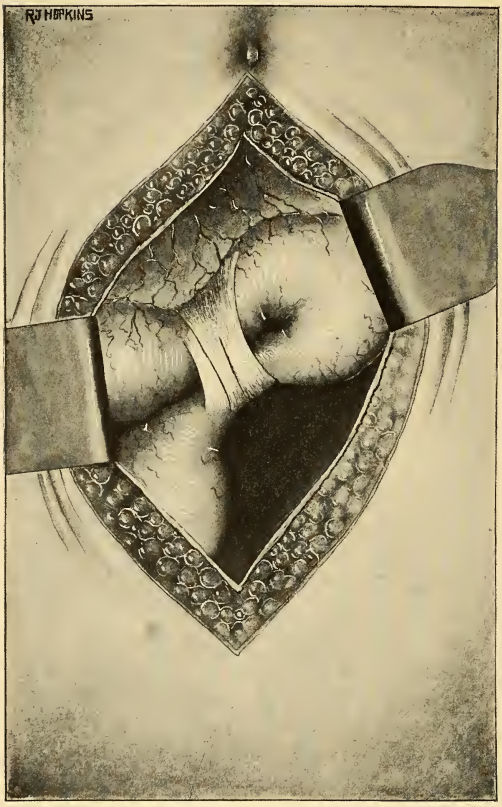

Fig. 214.—"Occasionally partial or complete obstruction is caused by bands of inflammatory tissue stretched across and confining the lumen of the bowel."—Robb (page 507).

Exacerbations occur with a sudden rise of temperature, which indicates that there is a further lighting up of the process or that it has extended into the peritoneum. Sometimes all the signs of a general peritonitis appear, and the prognosis in these cases is grave.

In the *diagnosis* of suppurative processes in the tubes the history is of great importance. If the patient dates her illness from an acute attack with the symptoms before mentioned, beginning after a labour or an abortion, or during the course of local treatment to the uterus, a streptococcous infection is strongly to be suspected. Some patients will give a clear history of a preceding gonorrhœa, while from others, careful questioning will elicit an account of an attack of vaginitis which we may safely put down as of gonorrhœal origin.

In still other cases, no date can be assigned by the patient to the onset of the disease, which has come on insidiously. Leucorrhœa may have been noticed for some time, with increasing pain at the menstrual period, or perhaps menorrhagia. The patients who are suffering with

a pelvic peritonitis are generally in a much worse condition than those in whom the suppurative process is limited to the tubes. But much variation may be looked for. Some women, despite the existence of a localized suppurative process, look well and robust though they complain of pain at times; while others are completely broken down, and

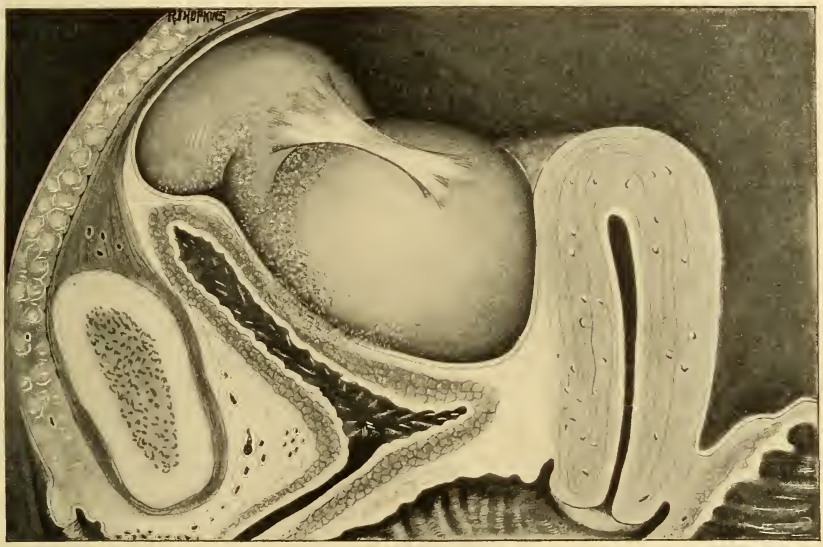

Fig. 215.—"Often the bladder is pressed upon by the inflammatory mass or becomes infected with the specific poison."—Robb (page 507).

show in their faces and in their general behaviour that they are chronic invalids. Some are without pain so long as they sit still or lie down, but the slightest movement or jarring may evoke severe suffering. When the pelvic abscess is situated elsewhere than in the tubes, the diagnosis by means of the physical examination taken in conjunction with the symptoms of pain, chill, fever, and rapid pulse, is comparatively easy, especially when the attack has followed parturition or abortion. When a mass is felt which bulges out the vault of the vagina and is very tender to the touch and fluctuates, we may safely conclude that we are dealing with suppuration of the tube or ovary, or both, with pelvic peritonitis. When the inflammation has been mainly confined to the tubes the diagnosis is more difficult, but it will often be possible to feel a mass coming off from the side of the uterus and, though intimately connected with it, having a mobility of its own. On attempting to move the mass we find it possible to do so to a slight extent, unless it has been bound down too firmly with peritonitic adhesions. Sometimes a mass is found on either side of the uterus, and in these cases we may be confident that there is tubal or tubo-ovarian disease on both sides. It is not always possible to recognise the presence of pus by palpation, since fluctuation may not be obtainable owing

to the thickening of the walls of the tube and the dense adhesions. Sometimes, however, when on gentle palpation the tumour has appeared to be solid, by manipulating the external and internal fingers so that the tumour is brought between them, a very distinct sensation of fluctuation can be obtained.

Again it must be remembered that in not a few cases of pyosalpinx there are only a few drops of pus in the tube.

In making a diagnosis of pyosalpinx the history is of great assistance, and it is often also of service in determining the etiology of the suppurative process.

The following data have been given by Kelly to aid in the diagnosis between a pyosalpinx of gonorrhœal and one of a streptococcous origin:

Gonorrhœal Infection	Streptococcous Infection
Slow in its onset, often preceded by inflammation of the external genitals and urethra.	Onset abrupt, following miscarriage, normal labour, or topical treatments.
Pain localized in one or both ovarian regions.	Pain more general and severe in the lower abdomen.
No signs of general peritonitis.	Usually signs of peritonitis.
Suffers more or less constantly, but may have no fever.	Suffers constantly, and usually has a septic fever.
Temperature 98.5° to 102° F. (38.9° C.).	Temperature 101° to 105° F. (38.3° to 40.5° C.).
Pulse accelerated, but of good quality and volume.	Pulse feebler and more rapid.
Attack lasts from five to fifteen days.	Attack seldom lasts less than a month, and may continue three months or more.
Often presents the appearance of good health.	Anæmic and weak.
Gonococci usually found in coverslip preparations from the cervical, urethral, or vulvo-vaginal glandular secretions.	Gonococci not found in the secretions.
History of marital gonorrhœa.	Husband sound.

Pyosalpinx is sometimes confused with appendicitis and other conditions to which we have already referred. As points serving to distinguish pyosalpinx from hydrosalpinx, Dudley gives the following:

Hydrosalpinx	Pyosalpinx
Systemic disturbance relatively slight.	Systemic infection often marked from absorption of pus.
Less fever, pain, and adhesions.	More fever, pain, and adhesions.
Bursting of the tube and discharge of its contents into the abdomen may give relief.	Bursting of the tube and discharge of its contents may cause dangerous peritonitis.
Walls of the tube distended, thin, smooth, elastic, and fluctuating.	Walls of the tube thick, hard, sometimes stony, resistant, nodular, less elastic, and less fluctuating.

Hydrosalpinx	Pyosalpinx
More usually associated with catarrhal endometritis.	More usually associated with purulent endometritis.
Thin, overstretched tubal wall easily ruptured.	Walls usually not so easily ruptured.

It may be said that a hydrosalpinx, while often very elastic, on acount of the great distention does not give fluctuation. Sometimes the wall of a pyosalpinx, instead of being thickened, is as thin as that of a hydrosalpinx. Great care should be exercised during the examination not to rupture any fluctuating tumour that may be found, as, by so doing, the risk is run of infecting the whole peritoneal cavity. In some cases a pyosalpinx forms a large tumour projecting above the symphysis, or more commonly toward one or other groin just above Poupart's ligament. With the history and combined internal and external examination, the existence of a suppurative process can be determined, but often only an operation can decide its exact nature, whether it is a suppurating cystoma of the ovary or a pyosalpinx.

Tuberculous Salpingitis.—In secondary tuberculosis of the adnexa, the symptoms are usually masked by those arising from the tuberculous process elsewhere in the body. Although the possibility of a primary tuberculous process in the tubes should always be borne in mind, experience has taught that there is nothing in the symptomatology characteristic of the condition. Even at the time of operation it has again and again escaped detection and has only been discovered later by the aid of the microscope.

CHAPTER XXXIV

INDIVIDUAL INFECTIONS OF THE FALLOPIAN TUBES

Infections by: (*a*) Gonococcus; (*b*) streptococcus; (*c*) *Bacillus tuberculosis*; (*d*) *Bacillus coli communis*; (*e*) pneumococcus; (*f*) staphylococcus; (*g*) saprophytes; (*h*) septic vibrion; (*i*) actinomyces.

Individual infections of the Fallopian tubes are, many of them, yet in course of preliminary investigation. Those which have been determined with reasonable accuracy and which, consequently, will be considered, although briefly, in this work, depend upon (*a*) the gonococcus, (*b*) the streptococcus, (*c*) the *Bacillus tuberculosis*, (*d*) the *Bacillus coli communis*, (*e*) the pneumococcus, (*f*) the staphylococcus, (*g*) the saprophytes, (*h*) the septic vibrion, (*i*) the actinomyces.

Gonococcous Infection of the Fallopian Tubes.—Infection by the gonococcus of Neisser (see Micrococcus Gonorrhœæ), according to the general consensus of competent observers, is responsible for a majority of purulent accumulations within the tubes and for those inflammatory changes which are induced thereby. This infection of the female genitalia, more conspicuously than any other, may be designated as of the ascending type; by which is meant that an infection beginning externally or within the vagina, gradually travels upward, chiefly, if not exclusively, by progressive invasion of the mucous surface until it reaches the Fallopian tubes. There remain, however, some unexplained facts in connection with this phenomenon: thus, gonococcous infection of the vulva and vagina is not uncommon among children (see Infections of the External Genital Organs); yet pus tubes are practically unknown in childhood. Of course, the immature development of the uterus before puberty offers a certain physical barrier to the upward extension of this affection in children; but it would seem that at least occasional instances would be forthcoming in which the obstacle had been overcome. There is a strong probability that investigation will establish the fact that the uterine mucosa of childhood with its dearth of epithelium is an uncongenial soil for this micrococcus. With the developmental impulses which come at puberty, however, these conditions are changed, and there are established a certain luxuriance of epithelium and a certain deepening of the utricular folds which are favourable to the propagation of the germs of gonorrhœa. (See Infections of the Uterus.)

Gonococci in the Fallopian tubes are found in the *pus* and upon the surface of the mucous membrane. They have been reported as being observed in the deeper layers of the tubes, but these observations have been seriously questioned by competent observers. Westermark was the first to demonstrate the organism in intratubal pus. His observations have been confirmed by Orthmann, Zweifel, Witte, Döderlein, Schauta, Morax, and numerous other observers in various countries. It is not always demonstrable in this medium. Reymond reports the observations of nine investigators, who have demonstrated the presence of gonococcus in tubal pus 78 times in 399 cases. The fact that it is not present in the pus of a given case at a given time is not to be construed as evidence that it was not the essential element of infection, for these micro-organisms perish in their own toxines, and thus disappear from the pus for the existence of which they are responsible. Gonorrhœal pus of recent intratubal origin reveals leucocytes of increased size, which contain groups of gonococci and epithelial cells also enlarged and inclosing the same micro-organism. A limited number of free gonococci are generally observable. Many observers have failed to find the gonococci in the *mucous membrane* in cases in which their presence has been demonstrated in the pus. This, as suggested by Reymond, is probably due to defective methods of staining. Gram's method is generally employed, but recent investigators have been able to demonstrate the presence of the gonococcus by the methylene blue and pure tannin method of Nicolle, after failing to find it by Gram's method. In a section prepared in this way by Morax there are observable, a layer of pus adhering to the mucous surface; leucocytes in the stroma of the mucosa; numerous epithelial cells that have lost their positions, form, and dimensions, but contain no gonococci; and, finally, both leucocytes and detached epithelial cells, which do contain gonococci. A distinguishing feature of these changes is that the epithelium is not thrown off *en bloc*, but the cells are shed individually. This manner of desquamation is the exact reverse of that which occurs in streptococcous infection. (See Streptococcous Infection of the Fallopian Tubes). The fimbriæ are studded with migrated leucocytes; the surface of the epithelium, says Reymond, is covered with a purulent layer, which is composed of a large number of leucocytes and detached epithelial cells. It is in this superimposed stratum that the gonococci are readily discoverable, not only in the epithelial cells and in the leucocytes, but lying quite free between the cells. It seems that these micro-organisms but rarely invade the epithelial cells which remain *in situ*, while the leucocytes which lie between the epithelial cells are likewise but rarely invaded. Competent observers have failed to discover the gonococci deeper than the adventitious layer that has just been described, although Wertheim asserts that he has found them in deeper structures. In this infection the muscularis is always engorged, its vessels being apparently multiplied in number and increased in calibre, while the lymphatics are filled with

leucocytes in course of migration to the mucous surface. The gonococci are not demonstrable in the muscularis, or within the leucocytes in that tunic. Wertheim's statement, cautiously made to the contrary, lacks confirmation, his alleged observation being explained by other investigators as due rather to defective methods of staining than to the actual detection of the micro-organisms. The inflammatory changes induced within the deep layers of the tube, however, and, particularly, the infiltration which occurs at the vestibule, are sufficient to cause an inflammation of the peritoneum, with resulting exudation and occlusion of the distal ostium of the tube. (See Infections of the Peritoneum.) Nevertheless, the gonococci themselves have been demonstrated on the peritoneal surface in these cases, both Cushing and Michaelis having reported instances of undoubted accuracy. It is probable that the explanation of this circumstance is to be found in the escape of the micro-organisms from the lumen of the tube before the closure of the vestibule. (See Morbid Histology of Salpingitis.)

The route by which the gonococcus travels from the seat of primary infection to the tubes, has been a source of speculation, which has, as yet, brought forth no definite conclusions. There are those who contend that it travels by progressive invasion of the mucous surfaces, by direct passage through the tissues, and by traversing the circulatory systems, respectively. Each of these three hypotheses has its advocates. That the mucous surfaces from the ostium vaginæ to the tubes are progressively invaded, seems to rest upon ample testimony. It is exceedingly probable from the observations of Camescasse, Rosthorn, and others, that, in the presence of a vaginal infection, the uterus is invaded in a much larger percentage of cases than was formerly supposed; while Steinschneider, after finding the gonococcus present in the cervix in every one of 34 consecutive cases of vaginal infection, concludes that the invasion of the endometrium is a universal incident of gonorrhœa in women. While this conclusion is certainly too sweeping to be justified by the observations upon which it is based, it is nevertheless to be looked upon as one of great significance. The behaviour of the gonococcus on the epithelial surfaces indicates that they offer to it the avenue of least resistance for its migration; and that, once within the uterus, and within the utricular folds of the endometrium, there is nothing to keep it from extending its invasion to the tubal epithelium.

There seem to be ample grounds for doubting that the gonococcus invades the deeper tissues without reference to circulatory media of communication. The fact, however, that it does reach the circulation, both sanguineous and lymphatic, rests upon indisputable evidence. Blumer, Thayer, and Lazear have cultivated it from the blood, while Flexner has demonstrated it at autopsy in lesions of ulcerative endocarditis. The latter observer states that the endocarditides associated with gonorrhœa, are commonly caused by the gonococcus, and that, in

these cases, a general infection with the micro-organism may take place. Inflammations of the pleura and pericardium, and suppurative myocarditis, have been caused by it. These facts establish beyond question that the gonococcus may invade the blood and be carried by that medium to remoter parts of the system. The common clinical phenomenon of suppuration of the inguinal glands (gonorrhœal buboes) in cases of acute gonorrhœa, shows the possibility of invasion of the lymph channels, while pelvic lymphangeitis, of similar origin, has a similar significance. These facts being established, it follows that the contention of Reymond and Magill, that the gonococcus does not travel from the seat of primary infection to the tubes through either the lymph or the blood channels, is not supported by analogy. If it is granted that the blood vessels may be invaded by this micro-organism, and that the lymphatics may likewise become the media of infection, it would seem that subepithelial structures are liable to invasion through these avenues. The controversy between Wertheim, on the one hand, and Reymond, on the other, and between their respective followers, touching this point, can only be settled in the light of further direct observations.

The *symptoms of gonococcous infection* of the tubes are not specially distinctive. The infection may follow either a virulent acute infection of the external genitalia, or it may be the result of a primary infection, so mild in character as to have escaped attention. The interval between a known primary infection and the manifestation of the disease in the tube, may be so great that the connection between the two may not be recognised. The natural history of the micro-organism and its pathogenic characteristics, is such that its activities are interrupted, and the patient may enjoy periods more or less prolonged of symptomatic health. When invasion of the tubes has taken place, however, there is generally an initial chill, which may be very slight, followed by an elevation of temperature, which may not go above 100° F.; while, on the other hand, these symptoms may be very intense. Pain is complained of at the base of each lower quadrant of the abdomen. This pain may be either sharp or lancinating, or it may be pulsating and may radiate into the lumbar region, or find expression in the sacral plexus or along the sciatic nerve. The pain is increased on external pressure or by the concussion incident to walking. Bimanual examination will reveal foci of tenderness in the neighbourhood of one or both Fallopian tubes, which will generally be found large and œdematous. These symptoms may be interrupted by a discharge of pus, either through the uterus or the intestine, followed by a period of apparent cure. Their return, however, is only a matter of time. The actual diagnosis of gonococcous infection can be based only upon a demonstration of the micro-organism in the pus. (See Diagnosis of Inflammatory Diseases of the Uterine Appendages.)

The *treatment of gonococcous infection* is given under the head of Treatment of Infections of the Fallopian Tubes.

Streptococcous Infection of the Fallopian Tubes.—Infection of the Fallopian tubes by the *Streptococcus pyogenes* generally occurs as an acute virulent inflammation—although this micro-organism is sometimes present when least suspected in the more chronic forms of pyosalpinx. Reymond and Magill, in their masterly contribution upon this subject (*Annals of Surgery,* 1896), state that they found the streptococcus in these cases only with difficulty. It would not respond to the culture tests made with ordinary media until after it had been revitalized, as it were, by successive inoculations. It would seem that the diminution in the virulence of the micro-organisms in some of these cases, accounts for the chronicity of symptoms following its entrance into the tubes. These authors, in a number of their cases, were unable to detect the presence of streptococci until after they had made repeated observations in cases which would ordinarily have been designated as sterile salpingitis. (See Streptococcus Pyogenes.)

The *symptoms of streptococcous infection* of the Fallopian tubes are to be studied in the light of the fact that, in the chain of morbid events, the invasion of the tubes always occurs secondarily to invasion of the uterus. While this is true, an equally important fact to be remembered is, that invasion of the tubes occurs so promptly after the primary infection of the uterus that the symptomatology of the two conditions is, in the majority of cases, essentially coincident. It is only in those cases in which the micro-organisms seem to have a diminished virulence, and in which the symptoms of uterine infection have subsided, that there are presented any distinct signs of involvement of the Fallopian tubes; for, in the presence of acute streptococcous infection of the uterus with associated involvement of the lymphatics and general engorgement of the pelvic tissues, the condition of the tubes is, as a rule, completely masked. The demonstrated existence of streptococcous infection of the uterus and of the surrounding structures may, however, be accepted of itself as a symptom of involvement of the tubes. It is true that in a limited number of cases this rule may fail, but even then it remains the safer guide for the treatment of the case. The constitutional symptoms of this form of infection are, in effect, those of similar infection of the uterus. (See Streptococcous Infection of the Uterus.) In a few instances the diagnosis may be confirmed by palpation of the enlarged tubes by bimanual manipulation; but it should be remembered that this is a dangerous expedient, as even slight manipulation may result in forcing some of the virulent pus from the tube into the peritoneum. The use of the aspirating needle for diagnostitial purposes in these acute cases is an even more dangerous procedure. The fact of a recent puerperal infection, the history of streptococcous invasion of the uterus, and the demonstrated existence of large tubes, are facts upon which a presumptive diagnosis may safely be based. The isolation of the streptococcus by microscopic examination and by culture and inoculation experiments, will clear up any remaining doubts as to the character of the disease.

The *pathology of salpingitis of streptococcous origin* in its general features is not unlike that already given. (See Morbid Histology of Salpingitis.) The morbid processes established by the streptococcus and the behaviour of the micro-organism itself, however, present some features that call for special mention. The thorough studies of this subject by Reymond and Magill (*Ibid.*), upon which this chapter is largely based, show that the pus from the tubes contains a relatively small number of leucocytes, but a great quantity of eliminated deformed epithelial cells, whose perinuclear protoplasm has often been lost. There are also present cells from a deeper layer, which seem to have fallen from the frame of the fringes. The streptococci are rarely in the leucocytes, more frequently in the epithelial cells, but most frequently between the cells. A slide mounted with the pus of streptococcous salpingitis from one of Reymond's cases (Fig. 216) shows desquamated epithelial cells, sometimes without their nuclei, connective-tissue cells, granular fatty degeneration, and numerous streptococci. The microbes are sometimes strung out in long chains, while in other cases they appear as diplococci, or as chains of three links, each one slightly elongated.

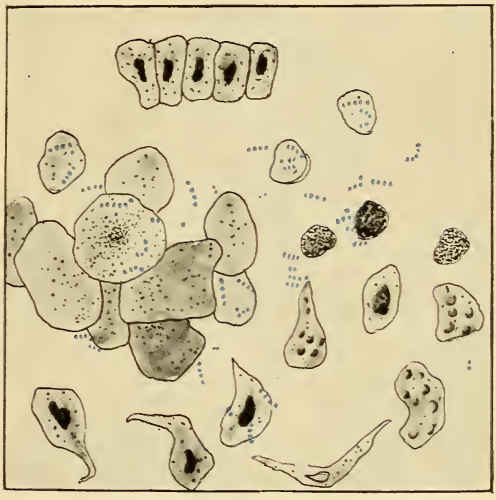

Fig. 216.—"A slide mounted with pus of streptococcous salpingitis from one of Reymond's cases."—Reed.

The mucosa is generally found at the beginning of the affection to have undergone but slight modification. The epithelial cells are yet in position and have retained to an important extent their cilia, the fimbriæ alone being a little thickened and infiltrated with leucocytes. In recent infection the streptococci are found in the calibre of the tube, while, according to Bumm, the streptococci throng about the epithelium of the pavilion, although they do not infest the calibre of the tube at its uterine third. It is inferred from this that the micro-organisms must have travelled over some other highway than that of the lumen of the tube itself, to have reached the vestibule. At a later period of the salpingitis, if the lumen remains open, the mucosa shows lesions of relatively less gravity than are manifested in the other tissues. The lymphatic situated in the centre of each fimbria is greatly dilated, and contains leucocytes and streptococci. The epi-

thelium in places, while almost intact, is not provided with vibratile cilia. At certain points, groups of streptococci are found beneath superimposed layers of epithelium, which is occasionally detached *en bloc,* leaving the fimbriæ denuded. The tissues underlying this denuded area are found more or less infiltrated with streptococci. These changes in the epithelium explain the presence of the detached epithelial cells in the pus. It is noticed that in streptococcous infection the superficial cell is not attacked by its free surface as in gonorrhœal salpingitis, but that the invasion comes from the deep surface. This is an essential distinguishing point in the pathology of the two infections. As a result of this assault upon the epithelial cells from their basement membrane, they fall in masses, and not singly as is the case in the presence of gonococcous infection. This desquamation, say Reymond and Magill, is so abundant as entirely to fill the calibre of the tube with the detached cells, which mass together and can clearly be distinguished from the fringes in a section.

The changes that take place in the terminal branches of the blood vessels are difficult to determine, and it is even more difficult to determine the relation of the streptococci to the blood vessels. The changes are, however, found most frequently at the periphery, where are sometimes noticed thrombi containing streptococci; at other times the endothelium of the vessels is seen to send out promontories into their lumen, and here are found streptococci both within and without the free passage of the vessels. These changes are all graphically shown in a section of a fimbria in streptococcous salpingitis, by Reymond and Magill (Fig. 217). These observers find in the relation of the streptococci to the vessels in these cases, confirmation of the conclusion of Labadie-Lagrave to the effect that "upon the blood is imposed the duty of destroying and attenuating the streptococcus." The micro-organism is found, particularly at the beginning, scattered through the cellular tissue of the aileron, and in the subperitoneal tissue also, as the adhesion is formed with the tube or the ovary. An abundant cellular infiltration is formed beneath the serosa, whose disappear-

Fig. 217.—"These changes are all graphically shown in a section of fimbriæ from a case of streptococcous salpingitis, by Reymond and Magill."—Reed.

ance leaves a point still marked by a group of leucocytes mixed with streptococci, which are also found in the cellular infiltration produced between the muscular sheaths.

Tuberculosis of the Fallopian tubes (Fig. 218) is the most frequent type of tuberculous disease of the female genital tract, and is char-

Fig. 218.—"Tuberculosis of the Fallopian tubes is the most frequent type of tuberculous disease of the female genital tract."—Whitacre.

acterized by the formation of miliary tubercles in the walls of the tube, by tumour formation, and by a progressive infection of the remainder of the genital organs.

A full appreciation of the frequency and clinical importance of the condition has only recently been obtained. While the monograph of Hegar (1886) did much to bring this about, that of Williams (1892) gave the condition a rank of prime importance, by demonstrating a very much greater frequency than had ever before been imagined, and by showing that a great many tubes, previously removed as adherent and inflamed appendages or passed over on the autopsy table without notice, were in reality tuberculous. These tubes gave no macroscopic appearance of tuberculosis and were called by him cases of "unsuspected genital tuberculosis." This possibility, when associated with the fact that excellent results are obtained by the removal of tubes in a condition of even advanced degeneration, has made it a leading subject in gynecology.

The method of infection of the tube by the tubercle bacillus forms an important, and at the same time a very difficult, question. We distinguish a *primary* and a *secondary infection* according as the tuberculous process arises primarily in the tube or is the result of an infection from a primary focus in the lung, intestine, or peritoneum. The latter is by far the most frequent mode of infection.

Hegar has differentiated an *ascending* and a *descending form* of infection, of which the latter is always a secondary tubal tuberculosis, while the former furnishes all the primary cases and may be a secondary tuberculosis. In the ascending type of infection, the tubercle bacillus must be mechanically deposited in the vagina or uterus by dirty fingers or instruments, from the clothes or the fæces of the patient who suffers from tuberculous enteritis, by coitus, or from a tuberculous ulceration of the vulva or vagina. It is conceded that the primary form of infection may be the result of coitus with men suffering from a tuberculosis of one or more of their genital organs. This belief is supported by these facts: (*a*) That tuberculosis of the female genital organs occurs with greatest frequency between twenty and forty years of age; (*b*) the recognition of the tubercle bacilli in the semen of such men (Dewille); (*c*) the demonstration of tubercle bacilli in the apparently sound genital organs of phthisical men (Fernet, Jani); and, finally, (*d*) the demonstration by Schuchardt of tubercle bacilli in the urethral secretions of gonorrhœa.

The method of the transfer of the germs from the vagina to the tube without infection of intermediate organs is a point difficult of solution. The escape of the intermediate tissues (vagina, cervix, uterus) has been very justly compared to the immunity of the nose, throat, and larynx, in lung tuberculosis and is explained by their natural protective forces. The tube lacks protection and seems to offer a most suitable nidus for bacterial development. The spermatozoa, by reason of their peculiar motion upward, would seem to be the most natural

carriers of adherent infectious material, and this method of transfer is accepted by Menge, Pozzi, Chiari, and Veit, but lacks definite proof. Hegar believes that the tubercle bacilius may enter by slight or extensive abrasions of the mucous membrane of the vulva, vagina, or uterus, travel in the regular course of the lymphatic stream, and find a lodgment in the outer end of the Fallopian tube or the ovary. This belief is supported (1) by the observations of Maier, who has shown that puerperal inflammation of the Fallopian tubes generally begins at the outer end; (2) by the fact that this channel of transfer has anatomical support; and (3) by the frequent occurrence of tuberculous salpingitis after childbirth and abortion.

The descending type of infection is more easily explained, since Pirmer has demonstrated that fine bodies (cinnabar or Chinese ink) injected into the peritoneal cavity will soon find their way into the tubal ostium through the tube and into the uterus. Added to this, we have the demonstration that the tubercle bacillus and other bacteria may pass through the intestinal wall in the floor of a tuberculous ulcer and float free in the peritoneal cavity (Mosler, Jans). The explanation here would seem to be complete. The tube may also become diseased through direct extension in continuity of tissue from a neighbouring tuberculous organ, usually from the peritoneum. W. Mayer has collected 194 cases of secondary tuberculosis of the female genital organs, in which number the peritoneum was diseased 110 times; indeed, a number of authors have considered this to be the almost exclusive method of tubal infection. A secondary disease of the Fallopian tube does not invariably result from a tuberculous peritonitis, however, as will be shown by the fact that Schramm found an idiopathic tuberculous peritonitis without disease of the tube 33 times in 3,356 autopsies. Tuberculous tumours of the rectum, sigmoid, or mesenteric glands, may also communicate the infection directly to an adherent tube.

An infection by way of the blood stream (hematogenous infection) remains to be mentioned, and there is no reason why this method should not be given the importance as a causative factor in the genital tract that is attached to it in bone, joint, and brain tuberculosis. The point of entrance of the germs may show no tuberculous changes and the only lesion in the entire body may be that in the tube; or the primary focus in the lung or in a bone, from which the embolus came, may be so small and difficult to find that a mistaken diagnosis of a primary disease may be made (Williams).

Morbid Anatomy.—The lesions of tuberculous salpingitis are usually bilateral although present in a different degree on the two sides. The general appearance of the organs will vary greatly with the stage, character, and severity of the inflammatory process. The type designated by Williams as "unsuspected tubal tuberculosis" will of course not be observed, and the more advanced cases will present every change from slight enlargement to the most extensive matting together of

pelvic contents and the formation of abscesses. The tubes that we usually see have already undergone a more or less high degree of change and their form does not vary as a rule in any way from that presented by ordinary pus tubes, and they present the features of a well-developed tuberculosis (Fig. 219). This picture of tuberculosis is formed by the presence of typical grayish-yellow or transparent miliary nodules on the surface; the lumen is dilated and filled by caseous

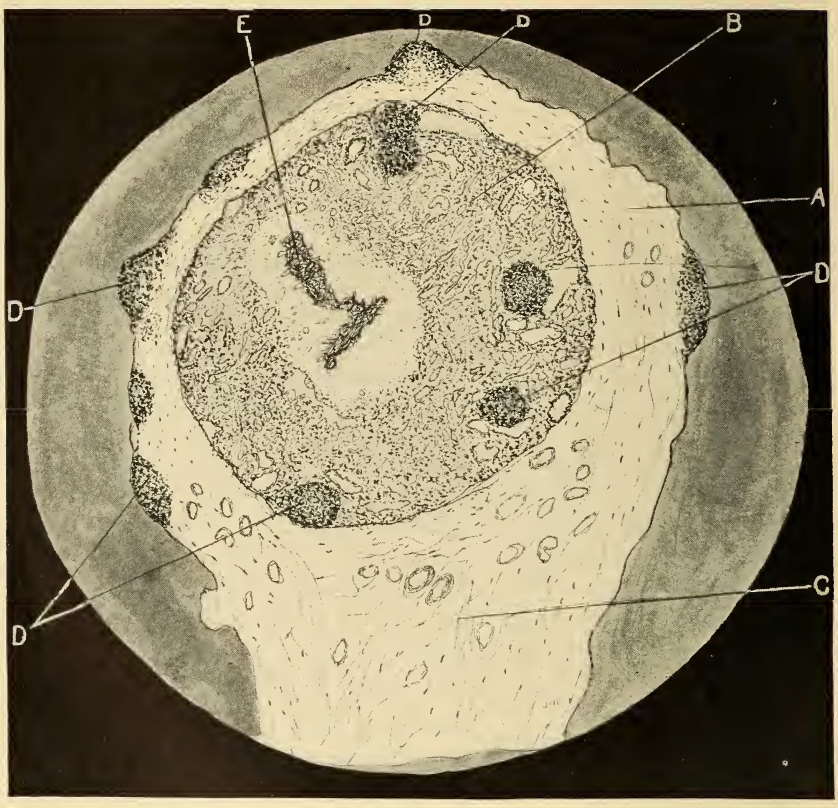

Fig. 219.—"The features of a well-developed tuberculosis": *A*, tube wall thickened; *B*, mucous membrane of the tube in a condition of adenomatous hyperplasia; *C*, broad ligament, much thickened; *D*, miliary tubercles on the peritoneal surface and in the mucosa; *E*, the lumen of the tube surrounded by a zone of caseous degeneration.—Whitacre.

material, and adhesions bind the tube down in the pelvis. The abdominal end may be open, when the fimbriæ are swollen and pushed over the opening; or, the ostium may be closed by a plug formed of pseudomembrane and tubercle tissue, when the tube may become dilated to almost any degree (Fig. 220), and may assume most surprising shapes. Veit has seen a case in which the isthmus of the tube was so distended as to give the appearance of an extension outward of

the uterine cornu (Fig. 221). The tube contents, according to their constituents, may be fluid, milky, of the consistence of cream or cheese,

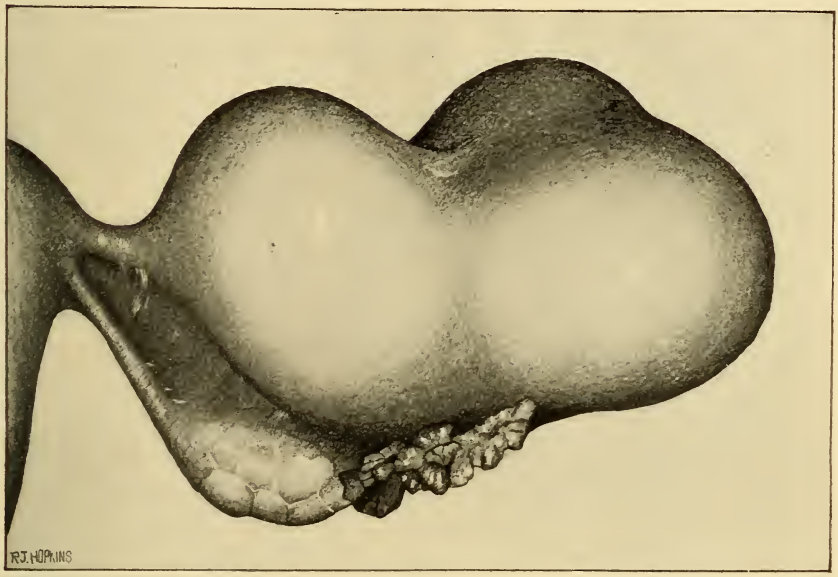

Fig. 220 (Veit).—"The tube may become dilated to almost any degree."—Whitacre (p. 522).

or at times chalky. The usual type is a grayish-yellow cheesy mass. The mucous membrane also shows marked changes and is covered by

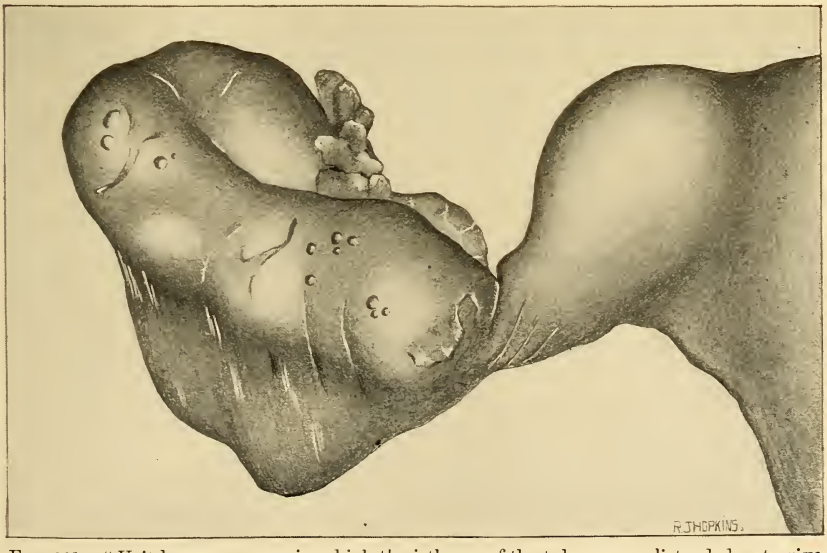

Fig. 221.—"Veit has seen a case in which the isthmus of the tube was so distended as to give the appearance of an extension outward of the uterine cornu."—Whitacre.

tubercles in every stage of metamorphosis. In prolonged cases it may be entirely replaced by a necrotic caseous mass. The wall of the tube is usually thickened.

The form of such tumours does not differ from that of tubes otherwise inflamed. Tumours of sausage, retort, and torpedo shape are the usual forms, while Hegar has placed special weight, first, on a *rosary-shaped swelling*, and, secondly, on a swelling at the *isthmus of the tube* that gives the appearance of an extension outward of the horn of the uterus. A closure of the outer end may result in a dilatation of the tube and a collection of pus that may reach two quarts (Stemann). The tumour will be further modified by the development of peritoneal products and adhesions. The position of the tumour shows all the variations that we might expect in severe inflammatory change. Switalski reports a case in which a tubal tumour the thickness of a finger was found in front of the uterus, lying on top of, and involving, secondarily, the bladder wall.

According to the manner of beginning, the lesions may be divided into an *acute* and a *chronic tubal tuberculosis*. The former usually follows a secondary, and the latter a primary, infection.

The *acute form* is characterized by an involvement mainly of the ampulla, and a rapid breaking down of the tuberculous mucous membrane which becomes changed into a cheesy detritus. Through this process the muscle is destroyed in part or in its entirety, and the lumen is widened to a certain extent. Microscopically, the mucous membrane shows a rich round-celled infiltration and numerous miliary tubercles but very few giant cells, owing to the promptness with which a central necrosis occurs in the tubercles. As the process advances, the mucous membrane becomes changed into a detritus containing many tubercle bacilli. The muscle layer shows distinct miliary tubercles between the fibres or caseous areas.

In the *chronic form* the abdominal end of the tube becomes promptly closed and a pyosalpinx forms. The destruction of the mucous membrane is much slower, the tube may be very much dilated by pus formation, and the thickening of the muscular wall may reach such a high degree that the tube is changed into a hard, stiff formation. *Microscopically*, this form begins by the deposit of minute miliary tubercles in the mucous membrane beneath the epithelial surface. These tubercles are discrete, typical in their structure, show very little tendency to caseate, and remain confined to the mucosa for a long time (Fig. 222). This stage forms the type of "unsuspected tubal tuberculosis," described by Williams, and will be revealed only on microscopic examination. An increased number of tubercles, however, will result in an infiltration and swelling of the folds of the mucous membrane, and the dilated lumen will be filled by what seems to be a caseous tuberculous mass but is found microscopically not to have broken down in any part (Martin). At other times the tubercle bacillus excites decided proliferation in the glandular elements to the degree of dis-

tinct *adenomatous tumour formations*. This has been observed with sufficient frequency to call for special mention (Wolff, Orthmann, Friedländer, Landau, Rheinstein, and others), and is considered to be a hyperplasia analogous to that of the epithelium in lupus. These growths may be confused with malignant tumours and it is important to remember their tuberculous origin.

Fig. 222.—"These tubercles are discrete, typical in their structure. . . . and remain confined to the mucosa for a long time."—Whitacre (page 524).

The tubercles of the chronic type have many giant cells and few tubercle bacilli. The muscularis does not become involved until very late in the disease, and its marked thickening must be looked upon as a hypertrophy of the muscle and connective-tissue elements, and not as a tuberculous growth. Tubercles may be found in the muscularis in the late stages. The serosa may be thickly covered by hempseed-sized tubercles and the tubal ostium is usually closed by adhesions. A true pyosalpingitis manifests itself in relatively few cases (Schröder, Winckel, Martin, Münster).

That not all cases permit of these lines of division into an acute and a chronic form is certain, but in general it will serve as a working basis. Williams has made a division into three forms: a miliary, a chronic diffuse, and a chronic fibroid form. His miliary form corresponds to the early stage of the chronic form described above; while the chronic fibroid form is described as one characterized by a rich formation of fibrous tissue in and around the miliary tubercles, and showing almost no tendency to caseation.

Both the closing of the tubal ostium and the fibrous thickenings found in the chronic forms seem to be a curative effort on the part of Nature. Yet it must be remembered that the caseous contents *may* escape from the open end of a tube into the free abdominal cavity (Hegar), and furthermore that encapsulation does not always occur when this does take place (Knauer).

Spontaneous healing may also certainly take place by a calcification of the focus (Kiwisch, Rokitansky), while a tuberculous abscess may heal by rupturing into the rectum, the vermiform appendix, or the small intestine (Veit).

The gonococcus has been found a number of times in tuberculous

tubes, and it would seem probable that a pre-existing gonorrhœal salpingitis would predispose the tube to a tuberculous infection.

Symptoms.—The symptoms of the disease are in general those of ordinary salpingitis, and may range in severity from entire absence in the miliary form to the most severe symptoms of salpingitis and pelvic abscess. Indeed, the symptoms, subjective and objective, are so little characteristic that the abdomen of such patients is usually opened for adherent tubes and ovaries or for pyosalpingitis. Not infrequently a family history of tuberculosis or the discovery of tuberculosis in other parts of the body or in the husband (Menge), serves as a starting point for the accurate interpretation of the symptoms. In cases of primary tuberculosis of the tubes, an important symptom is a more profuse and painful menstruation (Martin), while amenorrhœa is of course present in the cases of coincident phthisis. The pain may occur on one or both sides, but it must remain a question as to how much of the pain depends upon the tube and how much upon the peritoneum. The temperature is not elevated. Ascites may be present. Symptoms may persist practically unchanged for a long time, as has been shown by Werth, who reported a case in which the tuberculous process remained confined to the tube for two years and a half.

An extension of the process to the peritoneum gives much more characteristic features to the symptoms. A progressively increasing pelvic trouble, chronic in its nature and associated with tumour formation, the matting together of the intestines, disturbance of the rectum, and encysted ascitic fluid extending above the pubes, generally indicate tuberculosis. A secondary infection by the pyogenic cocci will of course initiate the more acute symptoms of sepsis. Lastly, a primary tuberculosis of the tube may lead to tuberculous peritonitis, phthisis, marasmus, or septic peritonitis.

Diagnosis.—From what has been said of the symptomatology it is apparent that the diagnosis is extremely difficult; indeed, Gehle, in 1881, stated that a positive diagnosis of genital tuberculosis could not be made. This statement, of course, loses all authority with reference to the accessible parts of the genital tract since the discovery of the tubercle bacillus, but it still holds true in a marked degree of those cases of tubal and ovarian disease in which the uterine curettings *do not* contain tubercle bacilli.

The history of the patient, heredity, and the existence of tuberculosis in other organs, are important points in the diagnosis. Hegar believes that a rosary-formed swelling of the tube occurs more frequently in this than in any other form of tubal disease, and has placed special stress upon a swelling of the isthmus of the tube at its exit from the uterine horn (Martin). Other writers believe that a swelling in the *outer end* is the common form of tumour formation. Attention has also been called by many observers to the hardness of the tumour, but it is certainly true that these features of form and consistence may be present likewise in pyosalpingitis.

If the tubes are not too firmly bound down, the diagnosis may be greatly facilitated by feeling tuberculous nodules on the surface of the tube, on the pelvic peritoneum, or on the posterior surface of the uterus. Edebohls lays great stress on a plaquelike thickening of the peritoneum. Osler says "the association of a tubal tumour with an ill-defined anomalous mass in the abdominal cavity should arouse suspicion at once." Tubercle bacilli *may* be found in the secretions of the uterus even though that organ be uninvolved, and Edebohls has once aspirated an abscess of the tube and discovered tubercle bacilli in the pus.

Prognosis.—The prognosis is always grave in either the primary or the secondary form. In the former, because of the marked tendency to extend to the peritoneum or lungs, and the tendency to a secondary pyogenic infection of a caseous mass; in the latter, because all these symptoms are added to the seriousness of the primary disease. The brilliant results obtained by the gynecologist, even in advanced cases, have done much during the past few years to counteract the absolutely bad prognosis of earlier writers, and we now know that a complete cure of the condition will follow excision in a great many of the primary cases, and that life will be much prolonged in the advanced cases. We are indebted to Hegar for this radical change in prognosis.

Treatment.—The prophylactic treatment of tuberculous salpingitis consists in cleanliness on the part of the physician and patient and in abstinence from marriage and coitus by people suffering from genital tuberculosis.

By reason of the great difficulties, nay, the impossibility, of making a diagnosis in many cases of primary tuberculosis, we are not often called upon to decide the question of treatment. Yet when the disease is discovered during an operation done for other conditions or when a diagnosis is made, there can be no question as to the advisability of radical removal. When the tubal disease is associated with tuberculous peritonitis, this condition gives an additional reason for operation rather than a contraindication. In patients suffering from phthisis, the treatment of a secondary tubal disease becomes a much more difficult problem. In general, the condition of the patient must be carefully considered and her chances of life weighed with and without operation. In other words, early cases should be operated on, late cases should not.

A double tuberculous salpingitis does not necessarily call for hysterectomy, even though the uterus does show involvement in a majority of cases, since curetting, combined with the natural resisting power of the endometrium, may overcome a mild infection.

A tonic treatment, pure air, and good hygienic surroundings, have the same value as in tuberculosis of other parts of the body.

The operative treatment of these cases is the only rational one, and the excellent results reported by a number of operators will justify excision, even in those cases in which the disease has extended far beyond the appendages.

Bacillus Coli Infection of the Fallopian Tubes.—The *Bacillus coli communis* has been found to be the essential micro-organism in certain cases of tubal infection. Deaver (*Virginia Medical Semimonthly*) states that there is frequently a close relationship between acute catarrhal appendicitis and right-sided acute salpingitis. While he mentions these as separate conditions, calling for consideration of their respective symptomatology for diagnostitial purposes, the causal relationship between the two is nevertheless suggested. The rôle of the *Bacillus coli communis* in appendicitis is well understood, but the extension of its influence to the Fallopian tube is not so easily comprehended or so generally recognised. Cases of salpingitis, however, in which the bacillus coli was present, have been reported by Morax, Girode, Hartmann, Doyen, and Reymond. Individual cases have also been reported by Guyon, Tuffier, and Schauta.

The *causation* of this infection may be summarized under the head of intestinal adhesion. The intestinal origin of this infection is emphasized by Reymond, who failed to find it in a single case in which the tube was not adherent to the intestine. Actual perforation of the intestine, however, does not seem to be essential to enable the bacillus coli to migrate from its native habitat to the lumen of the Fallopian tubes; on the contrary, there is ample evidence that the infection takes place by direct passage through the adhesions. There is no evidence, however, to justify the denial of a possible invasion of the tubes by progressive infection of the mucous tract through the vagina and uterus. The fact that the bacillus coli has been found in the vagina indicates the possibility of a general infection of the genital tract by that route. In six cases studied by Reymond and Magill, the conditions were all favourable for direct infection from the intestines. In one case in particular the right tube was adherent to the intestine and contained the bacillus coli, while the left tube, which was not attached to the intestine, did not contain that micro-organism. It would seem that the bacillus coli never occurs singly as an infectious element in the Fallopian tubes; on the contrary, other fine bacteria appear to accompany the colon bacillus, but they have not been classified. These bacteria have been observed by Witte, Morax, and Reymond and Magill, as small rods much more slender than the colon bacillus, immovable, colourable by Gram's method, and of variable length. They seem to add to the offensiveness of the pus in which they are found.

The *symptoms* of bacillus coli infection of the Fallopian tubes are essentially those of a pyosalpinx. In view of the fact that this bacillus has not been demonstrated in the tube in the absence of tubo-intestinal adhesions, and of the further fact that such adhesions only occur as the result of a previous infection of the tube, it follows that the history of the case must embrace the symptoms of the preliminary infection. This may be gonococcous infection or a streptococcous infection, or it may be a so-called mixed infection, by which is implied that un-

differentiated infection which is probably responsible for the majority of pus tubes. When, however, the bacillus coli penetrates the Fallopian tubes, the symptoms are more or less violent, the temperature running very high, sometimes to 105° F., following an initial chill. The rigors may be repeated, followed each time by exacerbation of the temperature, with increasing evidences of systemic intoxication, verging to the fatal point. Spontaneous relief may occur, however, by the abscess breaking into the intestine and thus draining away.

The *pathology* of this form of infection does not differ in essential particulars from that already given. (See Morbid Histology of Salpingitis.) The bacilli are found in variable quantity in the pus; sometimes in such quantity as to suggest a drop of culture bouillon. This, however, is exceptional, as in other cases the bacteria are so rare that microscopic examination of the pus is negative, the existence of the micro-organisms being revealed only by cultures. Leucocytes are rare in the pus, while the epithelial cells are more numerous. The manner in which the bacillus coli attacks the epithelium does not seem to be settled. If it is granted that the organism finds its way into the tube through the septum formed by tubo-intestinal adhesion, it follows, as a logical result, that it must approach the epithelium from beneath; whereas, if the method of invasion is through the uterus, it, like the gonococcus, attacks the epithelium from its free surface. Reymond and Magill record the significant fact that in all sections made and coloured by them with Nicolle's method, they were never able to find the bacteria elsewhere than in the salpingo-ovarian pocket, in the midst of eliminated cells, and at the surface of the wall. The progressive accumulation of pus is more rapid than in the ordinary infections, and results in extreme distention of the tube which may rupture either into the peritoneal cavity, or, as more frequently happens, into the intestine.

Pneumococcous Infection of the Fallopian Tubes.—The infection of the Fallopian tubes by the pneumococcus is rare, Reymond and Magill never having observed a case, although one each has been reported by Wertheim, Zweifel, and Frommel. It would seem that in this form of infection the mischief is always limited to the tube and does not extend to the ovaries. The majority of the cases are unilateral, the pus being small in quantity and the tube being closed at its pavilion. The investigators have not recorded any peculiar appearances in the microscopical sections from these cases.

The *symptoms* in the cases on record are those of an acute onset followed by high temperature. It would seem either that the pneumococcus is of varying virulence, or that the patients possess different degrees of susceptibility, since the escape of pus into the peritoneum in Zweifel's case caused no accident, while it proved rapidly fatal in the cases reported by Frommel and Witte.

The *causation* of this form of infection seems to be shrouded in mystery, for no satisfactory explanation has been made of the manner

or means by which this micro-organism is conveyed from its natural habitat to the Fallopian tubes. In none of the cases has pneumonia been present, although Stroganoff has observed a pelvic abscess that contained capped diplococci in several cases following pneumonia. It is stated that in cases of salpingitis no history of general disease which might be considered the primitive cause has been recorded. An examination of all the testimony tends to render untenable an hypothesis of the systemic origin of the infection. The probability of its entrance through the genital tract seems to be better founded. The cases of Witte and Frommel show that the infection was consecutive to puerperal accidents; while gonorrhœa was the antecedent factor in the cases of Girode and Zweifel. The facts, however, that the pneumococcus exists normally in the saliva, and that among certain people of depraved habits the saliva is sometimes used as a lubricant in vaginal manipulations, may explain its presence in that canal, where Doyen and others assert that they have found it. In view of the fact, however, that its normal medium is alkaline, it is hardly to be assumed that it will find a congenial environment in the presence of the acid products of the bacillus of Döderlein. The assumption, therefore, that the pneumococcus is to be classified among the normal bacteria of the vagina seems to be gratuitous.

Staphylococcous Infection of the Fallopian Tubes.—This condition has been assumed to be of frequent occurrence. This assumption, which does not seem to be well-founded, is manifestly based upon the important rôle which the staphylococci play in infections in general. These micro-organisms are not demonstrably present in a large proportion of salpingitides. Schauta found them but 4 times in 144 examinations. Menge found them once in 26 cases, Morax once in 33, while Witte found them but twice. Boisleux reports that he has observed them several times. It is a notable fact that several observers who have found them have discovered other pathogenic micro-organisms present in the same cases. Reymond and Magill have failed to find them, and, while not denying the accuracy of other observations, suggest that confusion may have arisen from the fact that there are found in and near the Fallopian tubes, saprophytes which may easily be confounded with the white and golden staphylococcus. The microscopic illusion is heightened by the fact that these saprophytes offer the same appearance on the slide and show cultural properties similar to the staphylococci.

Saprophytic Infection of the Fallopian Tubes.—Witte has observed harmless bacteria, in company with those possessing pathogenic properties, in the Fallopian tubes, but, like Reymond, has not come to a conclusion as to their proper classification. The latter notes the significant fact that they resemble the species which normally inhabit the lower portion of the genital tract, but is not prepared to believe that they are indigenous to the tubes. The conclusion of Sinclair, that the Fallopian tubes are normally free from bacteria, is in accordance with this view. (See Bacteria of the Fallopian Tubes in Health.) The

explanation of their presence in the tubes rests upon purely theoretic grounds. The fact that they are always found in connection with pathogenic bacteria suggests that they migrate thither under the escort of their more virulent congeners. They do not penetrate deeply into the mucosa but live upon its surface. In those cases in which they seem to be more deeply embedded, it is found, upon careful examination, that they are actually within an epithelial cul-de-sac which has become more or less displaced by the inflammatory thickening of the membrane. They are not discoverable in the muscular tunic.

Septic Vibrion Infection of the Fallopian Tubes.—Infection by the *vibrion septique* of Pasteur (*Bacillus œdematis maligni*) has been found in the Fallopian tubes by Witte. This organism, which has rounded edges, and varies from 0.8 μ to 1 μ in thickness and from 2 μ to 10 μ in length, was obtained in pure cultures by Liborius. It produces in the lower animals a hemorrhagic œdema in the subcutaneous tissues into which it is injected. The infection in such cases is limited to the immediate area of injection until after death, when it becomes rapidly diffused throughout the system. It is believed to be the cause of emphysematous gangrene in the human subject—although the rôle that it was presumed to play in producing gaseous phlegmons, is now known to be shared by the *Bacillus aerogenes capsulatus*. The gaseous manifestations were present in Witte's case of pyosalpinx. It has also been found by Giglio in company with the *Staphylococcus pyogenes aureus* in perimetric abscess. Its method of invasion of the Fallopian tubes, and the exact part that it plays in general pathology, are not accurately understood.

Actinomycosis of the Fallopian Tubes.—This condition has been observed by Zemann, the lumen of the tube being filled with pus in which the parasite abounded. The micro-organism (*Streptothrix actinomyces*) attacked the walls of the tubes, which were thickened and granular. The origin of the infection was not determined.

CHAPTER XXXV

TREATMENT OF INFECTIONS OF THE FALLOPIAN TUBES

The natural course and termination of inflammatory diseases of the Fallopian tubes—Hygienic treatment—Medicinal treatment—Local treatment—Massage—Electricity—Drainage: Indications; varieties—Vaginal incision or puncture—Inguinal or inguino-vaginal incision—Abdominal and abdomino-vaginal incision—Rectal puncture—Aspiration—Conservative operations on the tubes—Radical treatment—Salpingectomy—Tait's operation; modifications of Tait's operation—Abdominal panhysterectomy—Doyen's operation (vaginal hysterectomy); modifications, indications, and limitations.

The Natural Course and Termination of Inflammatory Diseases of the Tubes.—The treatment of any given disease should be based upon the knowledge of the natural history of that disease. The application of this rule to the treatment of infections of the Fallopian tubes, involves primarily a consideration of the natural termination, uninfluenced by operative treatment, of the inflammatory diseases induced by the infection. This, as stated by Clark, can not be done accurately in our present state of knowledge, for the reason that, during the last decade, in which the most advanced studies in gynecology have been made, there has been much greater activity in the operative field than in that of simple palliative treatment, or the treatment by topical applications and douches; consequently, no series of cases sufficiently large to offer reliable statistics has been reported. Notwithstanding this deficiency in statistics, general observations, as recorded by many gynecologists, point very strongly to the possibility of a restoration *ad integrum* in many cases of salpingitis which have hitherto been subjected to radical operations. In considering the prognosis in the acute inflammations of the tube, two principles in the pathology of these organs must be borne in mind. First, many tubal infections are self-limited; and, secondly, the mucous membrane of the tube is extremely difficult of destruction. With a decrease therefore in the virulence or cessation of the infection in the simple acute inflammations, the second factor becomes active and tends to restore the tube to the normal condition. Whether a perfect restoration occurs, depends upon the extent of the injury. While we accept unhesitatingly the statement that the majority of cases of simple tubal catarrh, and even of purulent salpingitis, terminate in a return to the normal, just as do acute catarrhal and sup-

purative processes in other mucous membranes, nevertheless when a widespread, round-celled infiltration of the muscular layers of the tube occurs, with a subsequent formation of new connective tissue, which renders the tissues dense, nonvascular, and more or less of a low vitalized type, an anatomic restoration is manifestly impossible. From the purely functional standpoint, however, this question is to be considered in another light. Accepting as true the statement that sterility in the latter class of cases is the rule, we should not by any means unqualifiedly infer that these patients will become chronic invalids, for according to our observation, some women even with extensive adhesions and distortion of the tubes still suffer little or no pelvic pain.

With the conservative spirit which now prevails among gynecologists in regard to the treatment of this special class of diseases, we shall no doubt find with the accumulation of accurate records that in simple catarrhal inflammations, and even in cases of undoubted hydrosalpinx, a self-limitation of the disease occurs, especially under the influence of rest, freedom from sexual intercourse, and the proper application of douches and other remedies.

The ordinary pyogenic cocci, such as the streptococcus, staphylococcus, colon bacillus, etc., appear to be more virulent in their immediate action than the gonococcus, but the latter is much more persistent and is especially prone to recur. When the ordinary pyogenic cocci gain access to the tube, their cycle of activity ends with the acute attack, after which, absorption in the case of hydrosalpinx, or even of pyosalpinx, may occur, whereas the gonococcus is frequently very persistent and is self-perpetuating. Once infected with it, the pathological process may extend over months and years, now better, now worse, depending upon the renewed activity of the gonococcus. These patients, therefore, are prone to become chronic invalids.

There is little danger to life in the acute or recurrent gonorrhœal attacks so far as the immediate effect is concerned, but the patient may drag out a miserable existence, suffering more or less pelvic pain for years. So far as the ultimate prognosis is concerned, our present knowledge seems to indicate a more permanent recovery in those cases which survive the primary infection from the ordinary pyogenic organism than from the gonococcus, at least so far as a restoration of the patient to a condition of freedom from pain and discomfort is concerned. Hydrosalpinx, while often very painful, is not dangerous, and patients tend to recover without operation, the fluid being absorbed just as in similar collections in other cavities. When aided by incision and puncture, the return to the normal is greatly facilitated.

While the pus of a pyosalpinx may, as stated, ultimately be absorbed, this appears to be the exception rather than the rule, for as in other collections of pus, Nature attempts to establish an exit; at least this is true in cases in which the pyosalpinx reaches a considerable size.

When the tube is small, slow gradual inspissation of the pus may occur, leaving, in its later stages, only a granular, cheesy matter.

In some of these cases, small calcareous bodies, which appear to be the residual *débris* of the inspissated pus, are also found. With the progressive accumulation of pus in the tubes, the coincident perisalpingitis results in firm adhesions to the surrounding organs, that prevent the rupture of the tube into the abdominal cavity. Pelvic peritonitis from contiguity of organs is quite common, in fact is almost an invariable rule, but widespread general peritonitis is quite exceptional as a result of purulent contamination through the rupture of the tube. For this reason, a procrastinating policy, so far as operation is concerned, should usually be pursued in gonorrhœal salpingitis, even if pyosalpinx is formed; for it is better to wait for the organisms to expend their virulence and die, rather than to operate in the acute stage when the temperature is considerably above normal. The tube, when distended with pus, frequently drops down into the pelvis posteriorly to the uterus, and often in cases of double pyosalpinx the retort-shaped vestibular ends come into contact. Following the rule with all purulent collections, the pus tends to rupture in the direction of least resistance. The isthmiac end of the tube being either occluded or very resistant, offers an effectual bar to the escape of the purulent matter into the uterus. The situation of the bladder, anterior to the uterus, while the pyosalpinx is posterior, renders this viscus a comparatively infrequent channel of egress. The intestinal canal, therefore, forms the most likely cavity into which the abscess will tend to evacuate itself. Because of the dependent position of the tubes in Douglas's cul-de-sac and of the intimate adhesion of the upper third of the rectum and the lower portion of the sigmoid flexure to them, rupture usually occurs at these points, although the small intestine may prove Nature's point of election. When once evacuated, the further secretion of pus may cease and obliteration of the cavity by granulation may occur; or, on the other hand, reinfection by the colon bacillus or other intestinal organism may take place through the intestinal opening, and a well-nigh interminable purulent process be inaugurated. Certainly, after a rupture into the intestinal canal has occurred, a reasonable time should be given for the closure of the fistulous tract before an operation is resorted to; for these are very unfavourable cases, the intestinal lesion introducing a dangerous factor into the operative treatment. In some cases, the pus points in the inguinal region, or gravitates downward under Poupart's ligament, appearing as a fluctuating swelling in the femoral canal.

Clark concludes a careful study of the natural history of inflammatory diseases of the Fallopian tubes with the statement that, *while palliative treatment should, by all means, be employed in the simpler non-purulent inflammations of the tube, so far we can see no reason to modify the surgical rule to liberate the pus by means of an operation rather than to wait for its natural evacuation; for Nature's method is usually*

very inferior to the clean, careful work of a good surgeon. If left alone, the patient is subjected to many months of very serious invalidism, whereas proper operative treatment is followed by much more certain and radical relief.

Hygienic Treatment.—While the prognosis in acute salpingitis varies according to the etiology, whether simple, gonorrhœal, or septic, the aim of the medical treatment in each variety is practically the same. We can not expect to arrest the process after it has once extended to the tube, but we can assist Nature's method of cure, which consists in the absorption of inflammatory products, the occlusion of the distal end, or the adhesion of the diseased tube to adjacent organs so that infectious fluids are shut off from the general cavity. Absolute rest in the recumbent position must be insisted upon, the patient not being allowed to leave her bed for any purpose. Sexual excitement is especially to be avoided—the husband being strictly cautioned as to this point. If the menstrual flow appears during the acute attack, these precautions are still more necessary. The regulation of the bowels is of primary importance, as thorough purgation often cuts short an attack, or at least limits the inflammatory process. Half-grain tablets of calomel, one every half hour, followed by teaspoonful doses of sulphate of magnesium or phosphate of sodium, are usually followed by several loose movements. If the stomach is irritable, six or eight ounces of a saturated solution of salts, may be introduced into the bowel through a long rectal tube. After the bowels have been opened, the saline laxative should be repeated daily. If the temperature is elevated above 101° F., an ice bag or cold-water coil, applied over the lower abdomen, not only relieves pain, but often controls the accompanying peritonitis. Some patients can not tolerate cold, but find more relief from hot stupes or poultices. Hot vaginal douches (110° to 115° F.) are exceedingly useful in the acute stage, but they should be given every six hours, not less than a gallon of water being used each time. High enemata of saline solution not only relieve tympanites, but stimulate the renal functions. Pain is best relieved by codeine suppositories, hypodermatic injections of morphine being given only when absolutely necessary. Strychnine is a more reliable stimulant than alcohol.

In short, the treatment of a case of acute salpingitis is identical with that of localized peritonitis, with the details of which the reader is sufficiently familiar. If adopted promptly and carried out thoroughly, most nonseptic cases will either go on to resolution with more or less restoration of function, or the patient will recover with thickened and adherent tubes, to become the subject of future medical or surgical attention. In the nonsurgical treatment of chronic salpingitis the physician seeks to relieve pain and disability, to promote the absorption of exudates and the stretching of adhesions around an imprisoned tube, and to restore its physiologic functions so that conception may become a possibility. While considerable confidence may be felt in reparative natural pro-

cesses, since the physician can not know the exact anatomic condition without opening the abdomen, he should be careful about promising a complete cure or entire freedom from subsequent attacks under conditions favouring fresh traumatisms or infection. It is assumed that the cases under consideration are those in which the tube is merely thickened and adherent, especially in Douglas's pouch, with or without accompanying disease of the ovary. A patient with this condition must be taught to take the best care of herself. She should, while taking daily exercise in the open air, be constantly on her guard against over-exertion, indulgence in violent sports (golf, bicycling, or bowling), exposure to cold, in fact, anything which might light up a fresh attack of inflammation. If sexual intercourse can not be interdicted, it should occur at infrequent intervals, with due cautions against violence or excess. Unless the cheerful co-operation of the husband can be secured, all treatment will be unsatisfactory. Rest during menstruation is a desideratum, at least during the first two or three days. Patients must be taught that this is the period when they are most liable to recurrent attacks. The deleterious influence of pregnancy and abortion upon old tubal troubles is well known, so that it is quite within the province of the physician to caution against the risks attending conception in subacute cases, especially those of gonorrhœal origin.

Medicinal Treatment.—Various drugs have been mentioned as having almost specific action upon tubal disease, such as bichloride of mercury, chlorate of potassium, and the iodides; but this action, when apparently beneficial, must be due rather to the improvement effected in the general health, especially in syphilitic subjects. Tonics and laxatives are always indicated. Careful regulation of the bowels by cascara, podophyllin, or salines, with occasional high enemata, should be a routine measure. Warburg's tincture, iron, and strychnine, are never amiss. For the correction of gastric disturbances and excess of uric acid, teaspoonful doses of phosphate of sodium in hot water act most satisfactorily; indeed, when this simple remedy is used habitually it is usually unnecessary to give any other laxative. The action of the kidneys should be stimulated by the daily ingestion of large quantities of pure water. Alcoholic stimulants are to be avoided, unless strongly indicated on account of the weak condition of the patient, especially during menstruation when they are apt to be used in excess to relieve pain. The temptation to resort to morphine to relieve dysmenorrhœa is strong, but should be resisted as far as possible. If opium must be used, codeine, in the form of suppositories, is preferable, or the coal-tar derivatives may be employed without overlooking their depressing effect on certain subjects. Counter-irritation over the abdomen with blisters, leeches, or the thermo-cautery, often affords temporary relief to local pain, but no actual effect upon the pathologic condition within the pelvis is to be expected. The same comment applies to painting the vaginal fornix with tincture of iodine. In scanty menstruation, iron

and manganese are indicated. Menorrhagia is treated with small doses of strychnine, ergot, and hydrastin, or stypticin in 2-grain doses every four to six hours until the profuse flow is checked. Since in these cases the endometrium is in a state of hyperplasia, curettement is usually the most direct method of relieving the symptom. It is hardly necessary to add that the hot vaginal douche is indispensable in the treatment of chronic, as well as of acute, salpingitis.

Local Treatment.—In the medicated tampon we have probably the best local agent for the treatment of diseased and adherent tubes. In many cases it certainly relieves pain and assists in the absorption of exudates, as proved by the marked diminution in the size and sensi-

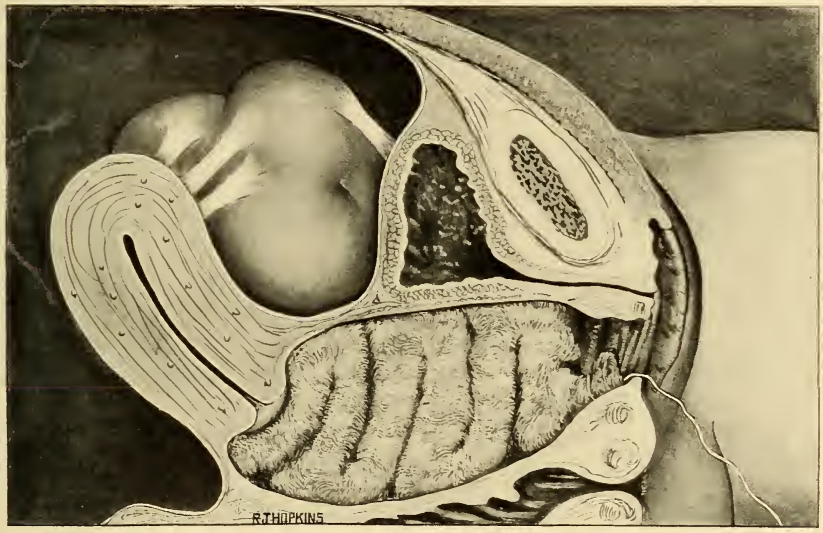

Fig. 223.—"Aside from the advantage gained by supporting enlarged and displaced tubes, the habitual use of the tampon seems to improve the pelvic circulation."—Coe.

tiveness of the pelvic tumour. That a *restitutio ad integrum* can be thus obtained, only an ultra-enthusiast would assert. Yet the persistent use of the tamponade has relieved many women from a state of invalidism when an operation seemed inevitable, so that they became practically well and were able to conceive and bear children.

Glycerine, boro-glyceride, and ichthyol, are the medicaments usually employed—the two latter in a 10-per-cent solution in glycerine. Aside from the advantage gained by supporting enlarged and displaced tubes (Fig. 223) (especially when the uterus is retroflexed), the habitual use of the tampon seems to improve the pelvic circulation, while the ichthyol-glycerine seems to have almost a specific action upon firm exudates, which soften and melt away under its influence. In order to accomplish decided results the tampon should be inserted at least two or three times weekly. The patient being in the knee-chest position and

the vaginal fornix exposed with a Sims's speculum, two pledgets of absorbent cotton saturated with the ichthyol solution, are pushed up firmly against the tumour and a dry tampon is applied on them. As the patient becomes more tolerant greater pressure can be exerted, the number of tampons being increased with the view of stretching adhesions and lifting the mass out of the pelvis. The patient is instructed to leave them *in situ* for thirty-six or forty-eight hours, meanwhile wearing a napkin on account of the discharge which always occurs. After they are removed, hot douches are used until the next treatment.

While patients learn to introduce the tampons themselves, it is a question if they ever push them beyond the cervix. To meet this objection King has devised a tube for injecting the solution into the posterior fornix, a dry pledget being afterward inserted to retain it in the vagina. In practice it has been found that, in order to accomplish the desired result, the tampon must be carefully introduced by the physician in the way described. It is impossible to do this properly through a bivalve speculum.

Massage.—So much has been written about pelvic massage that it is impossible to do more than touch upon it here. While Coe does not disparage this method of treatment, which has given such excellent results, he is not enthusiastic with regard to its application to the separation of intrapelvic adhesions. The unexpected extent and firmness of those often found on opening the abdomen, and the difficulty of separating them, even under the direct guidance of the eye, leads one to infer that the relief experienced from the massage of adherent tubes and ovaries, is due rather to improvement of the pelvic circulation and the general conditions of the patient, than to the actual absorption of exudates and the breaking up of bands of organized lymph. While an expert might venture in carefully selected cases to attempt the evacuation of pus and other fluids by "stripping" a distended tube into the uterus, the practitioner will do well to confine his manipulations to cases of thickened and adherent tubes in which there is no evidence of subacute inflammation, and where the first careful attempt is not followed by unpleasant reaction. The technique is briefly as follows: The patient lies upon a low couch, with her clothing thoroughly loosened, the knees flexed, and the hips raised on a cushion. The operator, sitting on a low chair at one side, introduces one or two fingers into the vagina and exerts steady gentle pressure against the mass, while his other hand makes counter-pressure over the abdomen. Some resistance may be experienced at first, but with patience the tension of the muscles will be overcome, so that the opposing fingers may be approximated, grasping the mass between them. Light kneading with the abdominal hand enables him to put the adhesions on the stretch. The rule in pelvic massage is, not to begin with the exudate, but to direct the strokes upward and outward, with the view of emptying the pelvic veins. The first *séance* should be tentative, not being prolonged beyond five or ten minutes. If marked pain is experienced during the

treatment, or pain and inflammatory reaction afterward, it is more than doubtful if it will prove beneficial. Should the first treatment be satisfactory, it may be repeated two or three times weekly for ten or fifteen minutes at a time. It is wise to suspend treatment just before and after the menstrual period. In order to save what has been gained in the way of stretching adhesions, it is well to introduce as firm a tampon as the patient can bear. In a favourable case, persistent massage will restore a considerable range of mobility to the adherent uterus and adnexa, so that it may even be possible for the patient to wear a soft rubber pessary with comfort. Circumscribed exudates are softened and absorbed and become insensitive, menstruation becomes regular and less painful, and the patient's general health is sensibly improved. It need not be added that pelvic massage, as thus outlined, is not to be confounded with the forcible separation of adhesions under anæsthesia, an operation which calls for special tactile dexterity and is not free from risk.

Electricity.—The extravagant claims of former electro-therapeutists are no longer regarded seriously. It is admitted that one need not look for any mysterious action of electricity upon diseased organs, whereby an anatomical cure may be obtained. It is simply an adjuvant in the treatment of pelvic diseases, serving to relieve pain and to stimulate the pelvic circulation. While, for the scientific application of this agent, elaborate and expensive apparatus is necessary, for ordinary office practice a good galvanic battery (preferably the dry-cell variety) is sufficient for gynecological treatment. A milliampèremeter, while useful, is not indispensable, since the patient's sensations and the after-effect of the treatment are the best guides in its application. Local pain is *the* indication for electricity. As in the case of massage, the contraindications are subacute inflammation and the presence of a suspected pus focus in or around the tube. A ball electrode, covered with wet clay, chamois, or absorbent cotton, and connected with the negative terminal, is introduced into the vagina and pressed against the sensitive mass, while the positive electrode (clay or wire gauze covered with cloth) is placed over the lower part of the abdomen. Beginning with a weak current, this is gradually increased up to 30 milliampères, or until the patient feels a distinct warmth or burning sensation, but no pain. Women differ greatly as to the degree of tolerance, but it is not well to exceed 50 milliampères. The *séance* lasts from five to fifteen minutes and may be repeated two or three times a week. The patient should experience subsequently a general feeling of well-being, with relief of the local pain. If it is found after two or three applications that the pain is increased, or if there is any other unpleasant reaction (rise of temperature, etc.), it is wiser not to persist with it. Intrauterine galvanization with the positive pole may be practised when menorrhagia is a marked symptom, but this is not generally recommended in connection with pelvic exudates. An equally good sedative effect is obtained by using the fine wire faradic

current with a bipolar vaginal electrode, and there is seldom any reaction. The patient's sensations form the best indications as to the strength of the current.

In touching briefly upon the nonsurgical treatment of salpingitis, Coe would *emphasize* (1) *the fact of its limitations;* (2) *the necessity for accurate diagnosis and care in the selection of cases; and* (3) *that an anatomical cure is not to be expected.* It is the aim of the physician, with the intelligent co-operation of the patient, to relieve symptoms and to preserve organs which, though diseased, are not a menace to life, and may under judicious treatment be restored to functional usefulness, if not to a normal condition. Operative intervention may in the end be necessary, but the patient's wish to make a fair trial of less radical methods should be regarded, and the results, even in cases which at first appear to be purely surgical, are often so good that an operation is avoided. If it is eventually performed, the patient's local and general condition have been so much improved by the preparatory treatment that the operation is rendered much easier and safer, and more satisfactory in its ultimate results.

Treatment by Drainage.—In certain cases of purulent accumulations, not only within the Fallopian tubes, but in the lymphatics and in the ovaries, the condition of the patient is such that a judicious operator may deem it advisable to improve her condition before attempting the radical operation. The initial step in such a course of treatment must be the removal of the pus.

The *indications and limitations of drainage* as a means of treatment in pelvic disease should be distinctly recognised. It may be said to be indicated in all cases in which there is manifestly an extensive accumulation of pus, and in which the active constitutional symptoms indicate that the causative pathogenic micro-organisms are not only yet alive, but virulent. In such cases, to attempt the removal of the Fallopian tube, for example, by abdominal section, would simply mean to expose the patient to an unnecessary hazard through the liability of rupturing the tube and consequently of contaminating the peritoneum. In all such cases it is better to evacuate the pus by some sort of puncture than, under the circumstances, to attempt the ablation of the appendages by either vaginal or abdominal incision. While this is true, it is nevertheless important to recognise that the treatment is essentially tentative; in other words, that it is a means of affording the patient only temporary relief, and of placing her in a reasonably safe condition for the more radical operation which, in the majority of cases, should follow. This is the only representation that the operator is justified in making to his patient. In numerous cases, however, symptomatic cures have followed drainage, but this result is never to be counted upon. It may be stated, as a rule, therefore, that pelvic drainage as an elective operation should only be employed as a temporary expedient, by which the patient may be put into a proper general condition for a radical operation.

The *varieties of drainage*, or, in other words, the various avenues and instrumentalities by which drainage may be effected in these cases, may be summarized as follows: (*a*) vaginal puncture; (*b*) inguinal and inguino-vaginal incision; (*c*) abdominal or abdomino-vaginal incision; (*d*) rectal puncture; (*e*) aspiration. Drainage when once established may be maintained by a tube, by gauze, or by open incision.

The **vaginal incision**, in certain cases more properly called **vaginal puncture**, is the method of election in the majority of cases.

The cases which are best adapted to this method of drainage are those in which the purulent accumulation lies behind the uterus in the cul-de-sac, or behind the posterior folds of the broad ligament upon either side, or in which the suppuration has occurred primarily in the lymphatics of the pelvis and has burrowed thence posteriorly or laterally round the uterus and the upper portion of the vagina. In such cases, the products of suppuration can be most easily removed through the vagina. The operation is done in various ways. The patient should in all instances be carefully prepared. Some operators prefer to place the patient in a recumbent posture, with her knees flexed well upon her thorax, the extreme Simon position, and, inserting a perineal retractor, to locate the most dependent portion of the purulent sac or cavity, which is then opened with a bistoury. This is far from being a safe method of procedure, for the reason that in practically all these cases there is more or less distortion of the tissues and consequent displacement of the blood vessels. A free incision, therefore, in a locality which, under normal conditions, will be entirely safe, may result, in these cases, in the division of the blood vessels and a consequent serious and often fatal hemorrhage. It is better, therefore, to adopt the method described many years ago by Clinton Cushing and to make this opening by means of a dilating plunger.

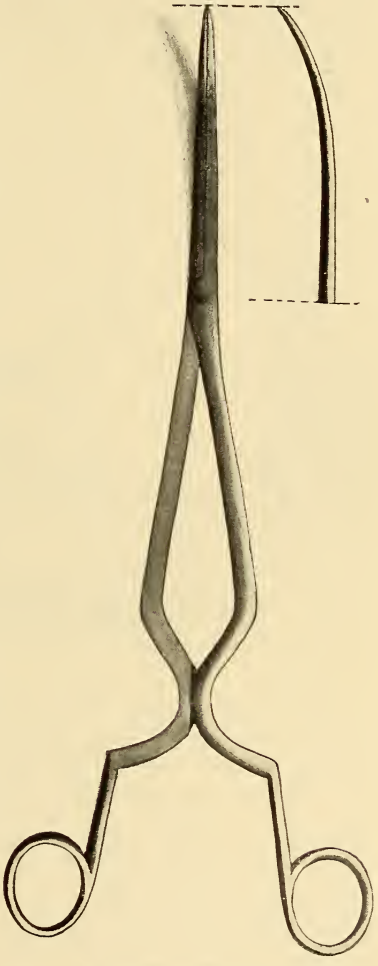

Fig. 224.—"Reed uses a sharp-pointed curved dilator" (page 542).

This consists in a pair of sharp-pointed dilators which are easily inserted, and, when opened, simply tear an orifice large enough to permit free drainage. Reed uses a sharp-pointed curved dilator (Fig. 224) and prefers to have the patient in a recumbent posture with her knees but moderately flexed, to have no perineal retractor, but to use his finger, exclusively, as a guide for directing the instrument, which can thus be inserted with greater accuracy in any direction (Fig. 225).

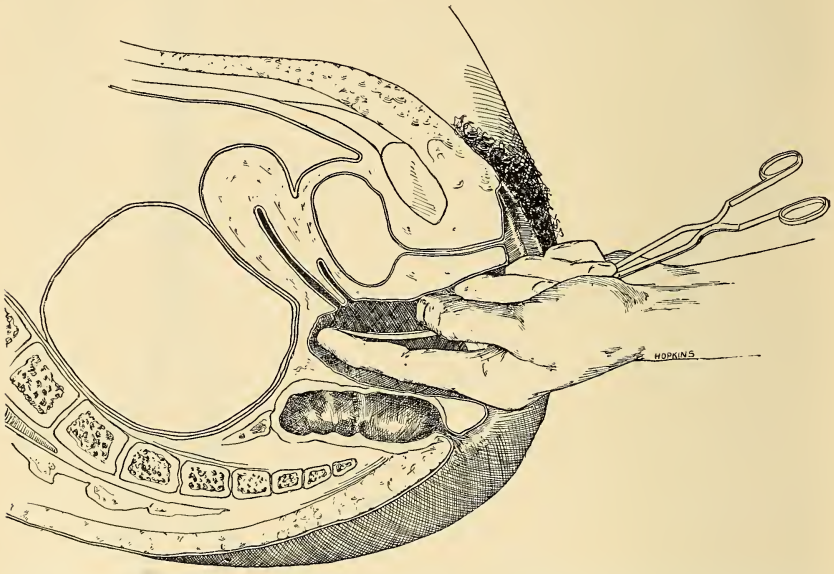

Fig. 225.—"Reed prefers to use his finger, exclusively, as a guide for directing the instrument."

The index finger should be inserted into the orifice thus formed, no hesitancy being experienced in exercising the necessary force to accomplish this end. A free exploration of the cavity is thus made, the abscess sac is washed out, first with a clear sterilized saline solution, and afterward with pure peroxide. Reed has latterly thrown in freely a solution of 95-per-cent carbolic acid, rinsing the part immediately with pure alcohol, and has found it the most effective antiseptic procedure that he has ever employed. After this, the cavity may be packed with sterilized bichloride gauze, or the drainage may be kept up, either from the start, or after the removal of the gauze by a self-retaining tube. This is easily prepared, as shown in Fig. 46, page 115, a T being formed. The arms of this T are together clasped in the tip of long forceps by means of which the tube is carried through the orifice at the vault of the vagina and the flaps allowed to expand in the pus cavity. A tube thus made and inserted may be worn for a week or even months without removal (Fig. 226).

The **inguinal** or **inguino-vaginal incision** is practised in certain cases where the pus has accumulated in the retroperitoneal structures,

and has lifted up and practically obliterated the folds of the broad ligament. Such accumulations occasionally occur in positions so remote from the vagina, and so distinctly above or surrounding the important blood vessels to the side of the uterus, that it is necessary to avoid the vaginal avenue of approach. It sometimes happens that a diagnosis of the exact condition and location of this accumulation can not be made until after the peritoneal cavity has been opened. The median incision, therefore, merely subserves an exploratory pur-

Fig. 226.—"A tube thus made and inserted may be worn for weeks or even months without removal."—Reed (page 542).

pose. With the finger on the inside of the peritoneal cavity and acting as a guide, an incision is made along the line of Poupart's ligament, just above its upper border, 3 to 5 centimetres in length. This incision is carried down through the fascia, below the peritoneal duplication, which is lifted by either the finger or a blunt dissector or the handle of a bistoury, the instrument thus employed being pushed forward until the pus cavity is reached. The operation may stop at this point, the pus cavity being treated by careful irrigation with a saline solution followed by peroxide, and then by 95-per-cent carbolic acid, followed, in turn, by the alcohol. It should then be packed with gauze or treated with drainage by tube. If the pus pocket has been found

to be sacculated and to contain a considerable amount of granulation tissue, it is probable that suppuration will be more or less indefinitely continued; to dispose of it, it would be better to secure through-and-through drainage and thus to take advantage of the force of gravity in disposing of the discharge. This is readily done by introducing within the pus cavity the index finger of the right hand, carrying Reed's dilator through to the vaginal vault or to the fornix, as the case may be, and with the index finger of the other hand acting as a guide in the vagina, pushing the dilator through and into that canal. The removal of the dilator is followed by the insertion of the intravaginal finger into the pus cavity. The lumen of the tube between these perforations should be obliterated by ligating, or simply dividing off and everting it. This is readily done by making two openings, one a little above the other (Fig. 227), and each long enough to permit the passage of a tube of similar size through it. The forceps is then passed through each opening (Fig. 228), the end of the tube is folded over and seized, and the tube is drawn through itself (Fig. 229). The result is that we have practically two tubes, one opening upon one side and the other opening upon the other side of a septum (Fig. 230). Thus made, the tube is carried through the inguinal opening, through the opening in the cul-de-sac, and out through the vagina (Fig. 231). The drainage tube should be kept from dropping too far into the wound, and from thus coming out through the vagina, by carefully inserting a safety pin through one side of the tube at a point corresponding to the cutaneous surface. The superficial incision may then be closed, except so much of it as is required for the accommodation of the tube.

Fig. 227.—"... by making two openings, one a little above the other."—Reed.

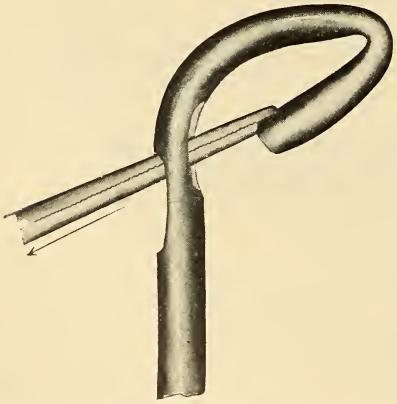

Fig. 228.—"The forceps is then passed through each opening."—Reed.

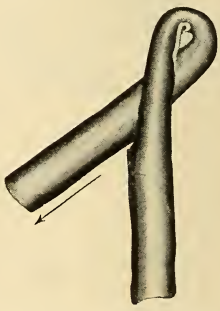

Fig. 229.—"... and the tube is drawn through itself."—Reed.

Abdominal and **abdomino-vaginal incisions** are practised for the purpose of abdominal drainage in cases in which the purulent accumu-

lation is situated behind the peritoneum, and is so large that the latter is pushed above the brim of the pelvis to such an extent as to permit the fixation of the peritoneal sac to the margins of a median abdominal incision. When this incision has been made and the abscess sac is found thus presenting, and it has been determined to practise drainage, the peritoneal surface of the sac should be fixed either by a few interrupted sutures or a single continuous suture at the peritoneal margin of the abdominal incision. After it has been thus fixed, an aspirator needle, (Fig. 232) or a small curved trocar may be inserted and a large quantity of the contained pus drawn off. After this has been done, the cavity should be opened by an incision, inserting the finger for the purpose of careful exploration of the inside. The pus should then be washed out and the cavity should be treated as indicated in the preceding paragraphs. If it is deemed desirable to practise through-and-through drainage, as is the rule in the majority of cases, the tube, already described, may be inserted (Fig. 233) by observing precisely the same pre-

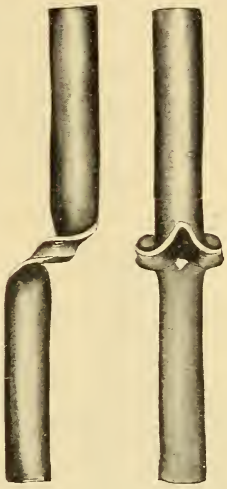

Fig. 230.—"The result is that we have practically two tubes, one opening upon one side and the other upon the other side of a septum."—Reed (page 544).

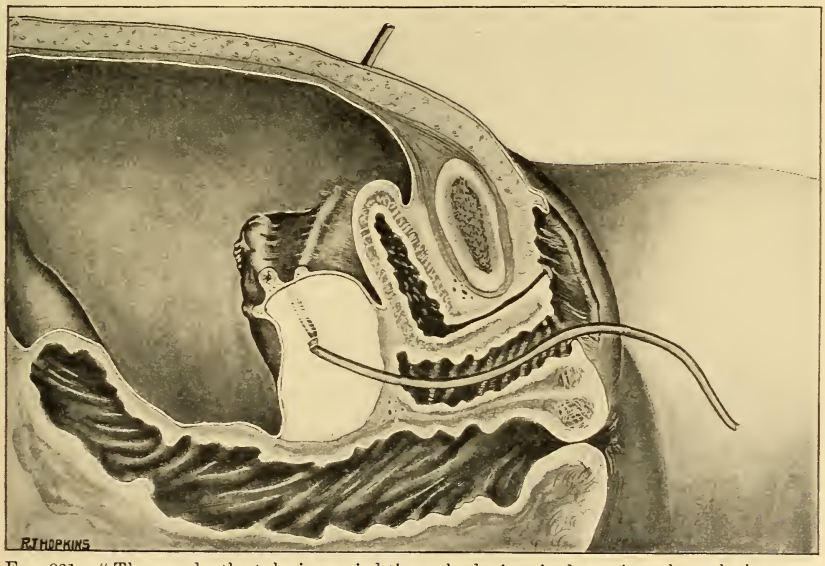

Fig. 231.—"Thus made, the tube is carried through the inguinal opening, through the opening in the cul-de-sac, and out through the vagina." (The uterus is cut away in the drawing, the left tube being shown.)—Reed (page 544).

cautions as already indicated. (See Inguinal and Inguino-vaginal Incision.)

Rectal puncture was devised by the elder Byford as a method of election in those cases in which purulent accumulations seemed to press into and point toward the rectum. In certain of these cases a digital exploration of the rectum will indicate a soft fluctuating point. Byford inserted an aspirator needle at this point and drew off the pus, and in certain cases even went to the extent of making a more palpable puncture. It was a convenient point of drainage and, contrary to what may be imagined, did not result in the formation of a fæcal abscess or fistula. When, however, the latter accident did occur, as has happened in a surprisingly limited number of cases, it proved to be so embarrassing as to seriously militate against the expediency of the operation. It is now but rarely adopted.

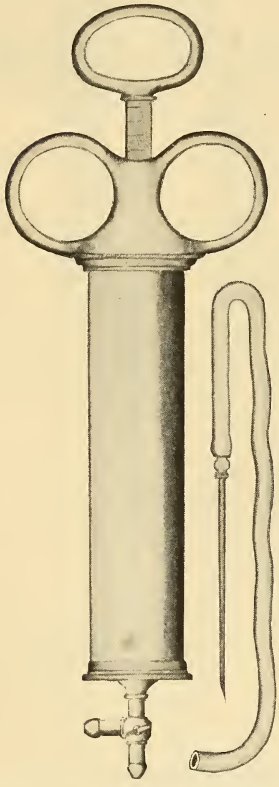

Fig. 232.—Aspirator (page 545).

Aspiration may be considered as a means of evacuating to a certain extent an accumulation of pus, rather than as a means of drainage; for the moment the needle is withdrawn the escape of pus is discontinued. It may be used, however, with a degree of safety through any of the avenues of approach at the most presenting point of a pelvic abscess.

Conservative Operations on the Tubes.—The *indications* for conservative operations on the tubes are more limited than in the case of the ovaries, since the main object aimed at is to favour conception. Hence the preservation of portions of the tubes implies that the uterus and one or a part of one ovary are left, otherwise the tubes would be useless.

There can be little room at the present day for discussion as to the propriety of not sacrificing the internal generative organs entirely unless they are hopelessly diseased; for experience has proved that, even when marked pathologic changes are present, recovery may take place without impairment of function, as shown by the persistence of menstruation and the occurrence of conception. Surgeons are now most concerned with the question of the limits of conservatism, in which there is much room for the exercise of the individual judgment.

The objections urged against the preservation of portions of diseased tubes, are the immediate risk of septic infection, subsequent extension of the disease requiring a secondary operation, and the probability

of the reforming of fresh adhesions. Most important of all, from the patient's standpoint, is the possibility that pain may be only temporarily, or not at all, relieved. These points the surgeon must consider at the time of the operation, being guided in his decision by the history of the case, the extent of the disease, the result of the bacteriological examination of fluid retained within the tubes, and, above all, by the expressed wishes of the patient, assuming that she is of an age when child-bearing is still possible. In general it may be stated, according to Coe, that when the operator feels reasonably sure that no extra risk will be entailed, a portion of one, or of both tubes should be left.

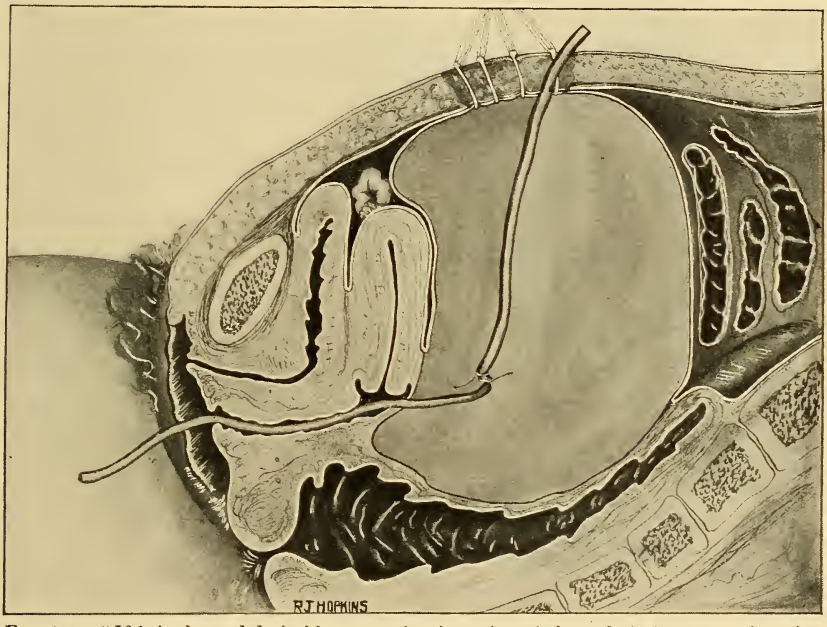

Fig. 233.—"If it is deemed desirable to practise through-and-through drainage, . . . the tube, already described, may be inserted."—Reed (page 545).

The simplest conservative procedure consists in liberating adherent tubes by gently separating all adhesions, beginning at the distal end and working upward with the fingers or blunt-pointed scissors, toward the uterus, care being exercised not to tear the delicate fimbriæ (Fig. 234). The tube and mesosalpinx must be entirely freed, straightened, and brought up to the normal position. A fine probe should then be passed down to the uterus, great gentleness being necessary to avoid a false passage. If the tube tends to prolapse, it is well to fix it to the ovary with one or two catgut sutures, which should include the serous coat, at a point near the fimbriated end. Fixation of the latter to the surface of the ovary so as to occlude the lumen, may result in the formation of a tubo-ovarian cyst.

The distal opening of the tube may be closed either by adhesions, or by the rolling in and agglutination of the fimbriæ without enlargement of the tube. The septum is laid open by radiating incisions with scissors, and the mucous membrane is united to the perineum with two or three interrupted sutures of fine silk or catgut. If fluid escapes on opening the tube, the surgeon must regulate his procedure according to its character. Blood or serum fluid may be evacuated by gently stripping the tube toward its distal end on a pad. Should pus be present, it may still seem advisable to save one tube, especially if the bacteriological examination shows that it is sterile, and if it is necessary to remove the other. After squeezing out the pus the tube is syringed out with normal saline solution, then with pure peroxide of hydrogen, and finally with salt solution. The tube is catheterized and restored to the pelvis, being sutured in its normal position.

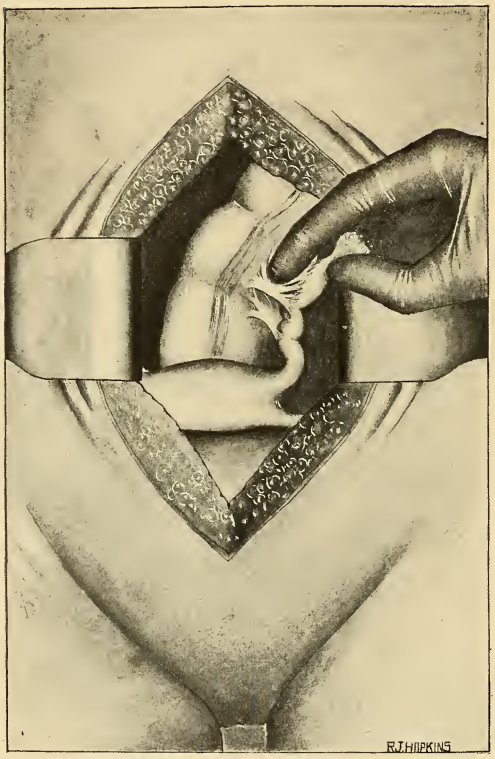

Fig. 234.—"The simplest conservative procedure consists in liberating adherent tubes by gently separating all adhesions."—Coe (page 547).

When the outer third or half of a tube is diseased, it is divided straight across with a scalpel, bleeding points being caught with forceps. The stump is catheterized and the end slit upon two sides; the mucosa is then sutured to the serous covering as before. The end is then attached to the surface of the ovary in such a way that it can not become occluded. If the tube is generally thickened or nodular, and is strictured in its middle third, the same procedure is applicable, or the strictured portion may be excised and end-to-end anastomosis performed, as in resection of the intestines.

Tubal abscesses adherent in Douglas's pouch are treated like other collections of pus in the pelvis—by vaginal incision, irrigation, and drainage. Kelly has suggested the treatment of such cases by the intraperitoneal method, by opening and cleaning the pyosalpinx, dropping the tube back into the pelvis and draining *per vaginam*. The same con-

servative treatment is applicable to cases of tubal abortion in which the opposite tube must be extirpated on account of extensive disease. (See Surgical Treatment of Sterility.)

The **radical treatment of suppurations of the Fallopian tubes** consists in the removal of the affected tube or tubes; and, when the infection has extended to the ovaries and produced destructive changes in those organs, they, also, are removed.

Salpingectomy.—While, according to Doléris, salpingitis is not a recently discovered disease, having been described by Spronius and mentioned by Morgagni in his thirty-eighth letter, its surgical treatment has been a matter of but recent development. It is curious to note, however, that according to Schlesinger (*Centralblatt für Gynäkologie*) a successful laparo-salpingotomy was performed in Russia in 1784. Dr. Seydel was the operator and the patient was a woman aged forty-two, the mother of three children, and had aborted two years previously to the disease which required the operation, viz., a small, round, and firm tumour observed in the summer of 1783. It was situated on the right side of the abdomen, and in size and consistence bore some resemblance to the uterus in the third month of pregnancy. The tumour grew visibly, especially during the courses, was accompanied by very violent pains, and finally reached the size of the head of a two-year-old child, at the same time becoming evidently softer. Vaginal examination showed that the tumour was connected with the uterus by a round and firm pedicle. In the winter of the same year the catamenia changed in type, while the pains occurred also in the intermenstrual period. The author explained to his patient (a student at his course for midwives) that he believed the right ovary to be diseased and, in his opinion, not to be curable without operation. The patient, though informed of the risk of the operation, consented.

The operation was performed on February 21, 1784, in the town of Sarepta, situated in the government of Astrakhan. The patient was prepared with baths, some doses of light laxatives and Peruvian bark; before the operation she received a small quantity of tincture of opium and saffron, syrup of white poppy, and Hoffmann's drops. After dividing the external abdominal coverings and the muscles in a line drawn from the umbilicus to the right inguinal region across the middle of the tumour, the author severed the peritoneum with a button bistoury, guided by the finger; three arteries were ligated; the protruding intestines were crowded back into the abdomen by means of a napkin soaked in warm milk; the spherical tumour, which was inclosed in a thick, firm capsule, and contained a fluctuating fluid, was connected with the uterus by a pedicle, and its upper limit reached the crest of the ilium; on the posterior and lower surface of the tumour the greatly enlarged fimbriæ of the tube were perceptible. The lower and lateral surfaces of the tumour were so closely adherent to the adjoining muscles and organs that it could not be isolated as desired; the author, therefore, concluded to open it. This having been done by a

long incision, there exuded a thick, sticky fluid, without odour, and of chocolate colour, weighing one pound and a half. Careful examination proved beyond doubt that the author had to deal with a tumour of the tube and not of the ovary: "Qua quidem investigatione certo et indubitato cognovi tumoris huius sedem non ovarium fuisse, sed tubam." A decoction of Peruvian bark and a solution of myrrh were then poured into the cavity of the tumour, and a wad of charpie soaked in Balsamum Arcæi was placed in the wound of the wall of the tumour. After the intestines had been isolated from the parietal peritoneum by pieces of linen dipped in oil of rose, the author bandaged the external abdominal wound with plaster and linen, but subsequently closed it by "suturæ cruentæ."

This operator seems to have been a man of keen surgical intuitions, for nothing else would have prompted him to undertake the operation, while his subsequent conduct of the case made him a prophet of the latter-day canons of surgery. In the first few days after the operation, he endeavoured to secure a free outflow of the fluid which showed a tendency to form in the tumour cavity, to accomplish which he had recourse to tents; these proved inefficient and he used a silver tube, which likewise proved inefficient, when the zealous surgeon with his mouth to the wound sucked the fœtid fluid from the cavity. He repeated this operation four times daily, the patient being directed to lie in the interval with her abdomen turned downward to favour drainage. The fever was thus kept down, the purulent secretion gradually diminished, the odour vanished, the wound contracted, and the patient recovered.

The scientific recognition of these morbid states and their treatment by ablation of the uterine appendages is due, however, to the masterly genius of the late Lawson Tait. In contributing this knowledge to science, this great surgeon conferred upon womankind a boon equal to that of ovariotomy itself. This achievement, among the many which stand to his credit, is of itself sufficient to entitle his name to a place upon the scroll of immortality. That the operation has been abused, does not militate in the least against its intrinsic worth, or against the fact that it is annually the means of restoring to life and health thousands of women whose untimely death could not otherwise be averted. It was Tait who first insisted that pus in the pelvis was subject to precisely the same laws of surgical treatment as pus in any other accessible portion of the body. This axiom, the acceptance of which was strenuously resisted by many who were manifestly unfamiliar with the technique necessary for carrying it into execution, has, in the twenty-five years which have elapsed since it was first enunciated, been accepted by the entire medical profession. To-day there are no dissenting voices. The extirpation of the uterine appendages, however, places beyond hope of redemption the loss of the reproductive function. This is always a matter of serious moment, and is a result to be avoided whenever possible. The beneficent impulses of the

medical profession have naturally become active in efforts to avert the extreme destruction induced by a naturally destructive disease. Efforts are, therefore, being made to conserve the organs and to perpetuate their functions. This conservative tendency, however, is not in contravention of the law of Tait, for the elimination of pus and the arrest of infection are just as much aimed at by conservative as by radical measures. There is a strong probability that the efforts at conservatism have thus far resulted in a larger proportion of failures to arrest the infectious processes, than is to be attributed to the radical operation; while the restoration of function, particularly as it relates to conception, while realized in but a small number of cases, must stand as the vindication of efforts to save the tubes or the ovaries in whole or in part. The present tendency and the present necessity, as stated by Coe, are, not so much to ascertain the limitations of the radical operation, as to determine just when the recognised conservative method should, and should not, be applied. It may be taken as a rule to which there are but few exceptions, that a tube that is the seat of infection resulting in purulent accumulation, associated with occlusion of both the uterine and distal orifices, is not amenable to any other treatment than that of extirpation. The exceptions to this rule, if there are any, can not be determined before operation. It has not yet been demonstrated that fimbriæ that have been curled inward and sealed by plastic exudation, have ever afterward become spontaneously disentangled with the restitution of the tubal orifice; nor has it ever been demonstrated that a Fallopian tube thus sealed can, without surgical intervention, again subserve the purposes of an oviduct. Conservative measures, such as drainage, may conserve the structural integrity of the tube, but they can not be expected either to restore or to perpetuate its functions. The conservatism thus practised must, therefore, have its distinct limitations. The expediency of conserving a functionally useless structure, which thereafter can be potent only for mischief, is open to serious question. The restoration of tubes which have been the seat of former infection may be undertaken as an operation of election in cases of sterility, in which the re-establishment of the reproductive function is a matter of extreme necessity. (See Operative Treatment of Sterility.)

Tait's operation for removal of the Fallopian tubes, as practised by Tait himself, included the removal of the ovaries, and is known as *abdominal salpingo-oöphorectomy.* There were several reasons why the procedure was made thus comprehensive. In the first place, the ovaries were generally found to be the seat of disease sometimes as active and as destructive as that in the tubes themselves; in the next place, an ovary without a tube is useless for reproduction; in the third place, an ovary left in position may subsequently become the seat of neoplastic or degenerative changes, if not of infection, and thus be a source of danger to the patient; and, finally, the ovary could be removed with the tube without adding to the hazard of the operation. These

reasons seem cogent enough and are yet to be recognised as having extreme weight. Bland Sutton and others, however, have insisted with reason upon the importance of leaving a healthy ovary or a part of an ovary *in situ*, to avert the neurotic storms which attend the sudden precipitation of the menopause, following the complete ablation of the appendages. This innovation, however, does not modify to any important degree the essential technique of the operation.

The patient is prepared and the incision is made in accordance with the directions already given (see Abdominal Section). As soon as the abdominal cavity is opened, the patient being, during the entire operation, in the dorsal recumbent posture, the surgeon introduces one or two fingers, permitting their palmar surface to glide down the parietal peritoneum over the collapsed bladder to the fundus of the uterus. This is the important landmark from which subsequent exploration of the pelvis is to be made. Feeling to one side of the uterus, the condition of the Fallopian tube and of the ovary upon that side is thoroughly ascertained. Going back to the fundus of the uterus and exploring the other side, the other tube and ovary are likewise examined. It is sometimes difficult to outline these structures, as in the presence of a recent inflammatory exudation, or, in the presence of old and firm adhesions, the identity of tubes and ovaries may be lost in an apparently homogeneous mass. The next step should consist in a search of what Joseph Price so aptly designates as a point of cleavage. As soon as this is found, one finger should be used to gradually and firmly, but gently enucleate the inflammatory mass from the parietal peritoneum. In conducting this manipulation it is important, first, to have obtained a correct idea of the approximate location of the diseased tube. It generally occupies a position behind the posterior fold of the round ligament, or even in the cul-de-sac of Douglas, but it may be found lying between the uterus and the bladder, or attached to the omentum, or, as in one of Reed's cases, to the mesocolon (*Cincinnati Lancet-Clinic*). Care should be taken—especially in acute cases associated with high temperature—to avoid rupturing the pus sac and thus bathing the peritoneum with the virulent elements of infection. This accident may be guarded against by previously packing the pelvic cavity with a gauze napkin, which should be so arranged as to prevent the dissemination of the pus. When the tubes have been peeled out of their nests, first one and then the other should be brought up into the abdominal incision. The pedicle formed by the ovarian ligament and the broad ligament is next transfixed by passing through the broad ligament a needle loaded with the ligature. Tait employed what is called a Staffordshire knot. This consists in bringing the loop of the ligature back, over and around both the tube and the ovary; the looped end is then placed between the free ends of the ligature and drawn tight; the free ends of the ligature are then securely tied by a surgeon's knot and are cut, leaving not less than half an inch beyond the knot. In applying this ligature, care is taken

to have it impinge on the tube at its uterine juncture and to have it encircle the ovarian ligament. The tube and ovary are then cut away by scissors, care being taken to leave enough of the pedicle to prevent the slipping of the ligature. In certain of these cases the engorged mucosa will obtrude from the pedicle, in which case it should be cauterized by passing a probe, previously immersed in pure carbolic acid, into its lumen. The appendages on the other side, if diseased, are treated in a similar way. The toilet of the peritoneum is now made. This, as practised by Tait, consisted in flushing the peritoneal cavity, or more properly the pelvic cavity, with pure boiled water. If there was any oozing or if a pus tube had been ruptured, Tait inserted a glass drainage tube. This consisted of a piece of glass tubing long enough to reach from the cutaneous margin of the abdominal incision to the floor of the cul-de-sac; it had a number of small perforations in the lower 2 or 3 centimetres of its wall, and it was made to flare slightly at the top. Through this drainage tube, blood and serum was pumped by means of a suction apparatus, at intervals varying from half an hour to an hour until oozing ceased. The abdomen was then closed by interrupted sutures, Tait using silk both for the pedicles and for the abdominal incision. Tait's dexterity in performing this operation was the marvel of surgery in his day. His technique is today religiously followed by many of the most eminent and successful operators.

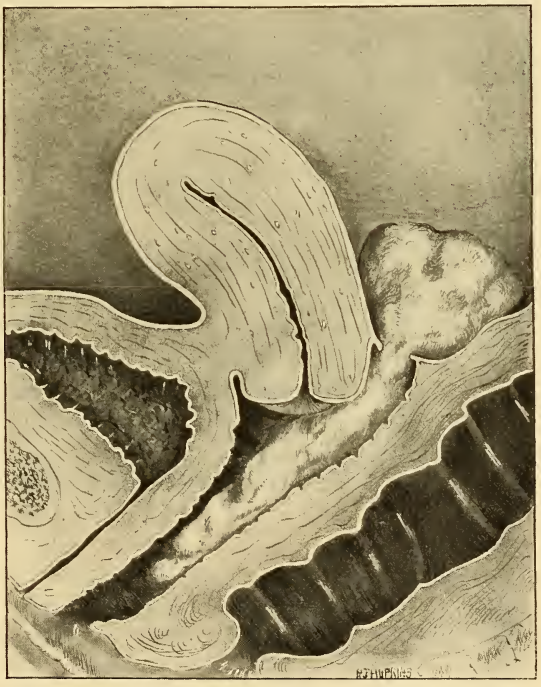

Fig. 235.—". . . Draining *per vaginam* . . . by gauze is generally preferred."—Reed (page 554).

Modifications of Tait's operation have altered its technique to a slight degree without in the least modifying its principle. Thus, the Trendelenburg position is largely employed. The ovaries are now occasionally left *in situ*, the diseased tubes alone being removed—a line of practice which is yet distinctly in its experimental stage. A hydrosalpinx is now occasionally

incised, drained, and dropped back—a method of treatment that yet awaits justification. In ligating the pedicle, but few operators now employ the Staffordshire knot, those who still cling to the *en masse* method, preferring to use that known as the figure-of-eight ligature. Many operators, however, prefer to control the ovarian artery primarily by snap-forceps, and then, after cutting away the ovary and the tube, to ligate the vessel, with its associated veins, individually; the peritoneal folds of the broad ligament being sutured over the ligated extremities of the vessels. Catgut is now very generally employed instead of silk for both ligatures and sutures. Drainage, in the presence of assured hemostasis, is but rarely employed, and when it is, Martin's method of opening the floor of the cul-de-sac and draining *per vaginam*, either by a self-retaining tube or by gauze, is generally preferred (Fig. 235). In the presence of persistent oozing, a gauze pack is sometimes adjusted

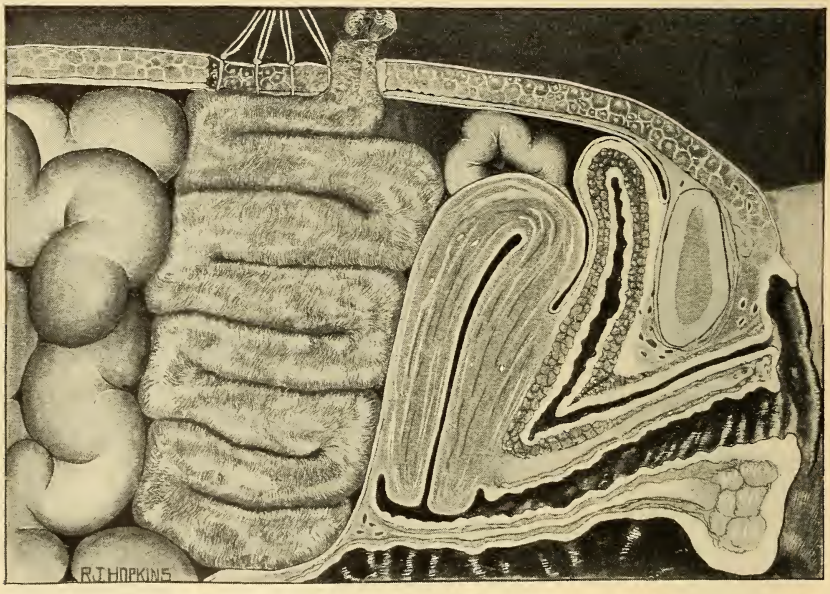

Fig. 236.—"In the presence of persistent oozing, a gauze pack is sometimes adjusted."—Reed.

(Fig. 236). The toilet of the peritoneum is now generally made by means of pieces of dry sterilized gauze, by which the cavity is mopped out. The abdominal incision is now closed by many operators by means of the laminated suture. (See Abdominal Section.)

Abdominal panhysterectomy has been adopted by many operators (Fig. 237) for the radical treatment of purulent infections of the uterus and adnexa. The technique does not differ in any particular from that already described. (See Abdominal Panhysterectomy.)

The reasons for adopting this operation are practically those which prompted Doyen, Péan, Segond, and the French school in general,

to adopt vaginal hysterectomy in these cases. In the first place, in certain of the infections, notably that by the streptococcus (see Streptococcous Infection of the Uterus), the parenchyma of the uterus is invaded, with the result that more or less permanent changes are estab-

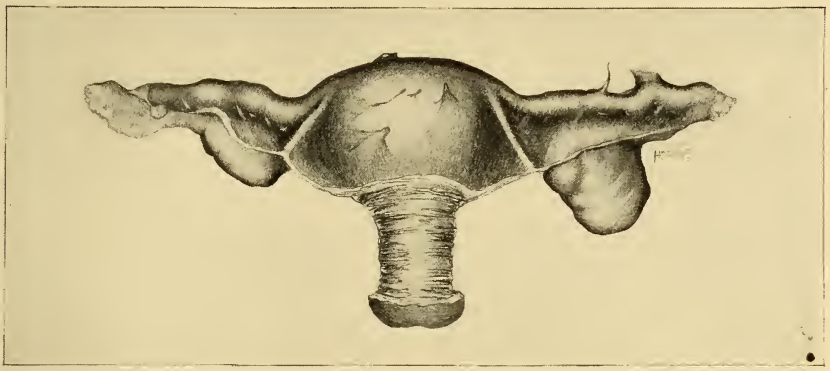

Fig. 237.—"Abdominal panhysterectomy has been adopted by many operators . . ."—Reed (page 554).

lished; even in cases of gonococcous infection, in which the pathologic changes have been manifested in the deep utricular glands and in the muscular stroma with which they are surrounded, hyperplasias of a more or less permanent character are established. These are the cases which furnish the distressing examples of persistently painful uteri following ablation of the appendages. It is to be acknowledged that the removal of pus tubes does not restore many of these cases to even symptomatic health. In many cases an infected uterus, in spite of repeated curettage, remains an infected uterus after the removal of the diseased appendages. For this reason the French school of surgeons, with practical unanimity, has adopted the practice of removing the diseased uterus with the diseased adnexa. The results have justified the practice. According to the observation of Reed, the primary surgical recovery from this operation is more uniform and attended with fewer embarrassing incidents than that following the ablation of the appendages. The choice between panhysterectomy and supravaginal amputation in these cases rests upon no debatable ground. If the operation is undertaken because of infection of the uterus, it would be manifestly improper to leave a part of that infected organ *in situ*, particularly when its complete removal can be as easily and as safely effected. Reed prefers the abdominal to the vaginal section, for the reason that it places all possible complications under more complete control. Doyen admits that abdominal section is the operation of choice in the presence of large adnexal tumours and also of probable tuberculous peritonitis. Pryor, with equal frankness, acknowledges that vaginal ablation should not be attempted in the presence of complicating intestinal lesions. In these acknowledgments

are found important limitations of the vaginal method, and equally important reasons why the operation should be done by abdominal section. The frequency with which unsuspected adhesions between the tubes and the intestines are encountered, and the known impossibility of diagnosticating all, or even a majority of these cases, before exploratory incision, constitutes sufficient reason for invading these cases from above. The remoteness, in an anatomical sense, of many of these complications renders impossible their detection by vaginal exploration. Richelot, a former partisan and present friend of vaginal hysterectomy, states (*Annals of Gynecology and Pædiatry*) that in 1 out of every 2 cases in which he did vaginal exploratory incision, he found conditions which rendered the other route more desirable, and that he consequently had occasion to regret his diagnostic ability, but "today," he adds with captivating *naïveté*, "I no longer have any regrets, because total abdominal hysterectomy gives me complete cures." Miller (*Bulletin of the Johns Hopkins Hospital*) concludes, after a careful bacteriological examination of 68 uteri removed by operation, that "in uncomplicated cases of hystero-myomectomy, hysterectomy for inflammatory cases or ovarian tumours, in operations for extra-uterine pregnancies, and in all such cases where the vagina and cervix were normal except probably for invasion by the gonococcus, the safest route so far as infection is concerned is the abdominal." Miller, however, fails to explain why invasion by the gonococcus should be made an exception. Zweifel employs the abdominal method of complete hysterectomy, and in 65 of his cases, studied by Abel and reported in 1894, both the primary and ultimate results were uniformly satisfactory. Fritsch, Martin, and Jacobs, object to the retention of the cervix or any part of it in hysterectomy for infections involving the uterus and appendages, urging as a reason for their position, that the cervical mucosa, however carefully treated, may act as the nidus of infection, which, under such circumstances, may and frequently does invade the field of operation.

Doyen's operation for infections of the Fallopian tubes consists in a vaginal hysterectomy including the removal of the Fallopian tubes and the ovaries with the uterus. The operation was first done for this purpose in 1887, although Doyen had previously adopted practically the same technique for nonsuppurative diseases of the appendages.

The operation is performed by placing the patient upon her back with her knees well flexed, when the perineum is retracted and the cervix is seized with a strong forceps, one forceps being applied to each lateral lip. The cervix is now drawn down by firm traction and an incision is made in the posterior cul-de-sac by means of curved scissors, a bistoury never being employed. The peritoneum, if free, is opened by the second or third cut of the scissors, permitting the escape of a few grammes of normal peritoneal fluid. The right index finger is now introduced into the serous button-hole for the purpose of exploring the posterior surface of the uterus and that of the append-

ages. If adhesions are found to exist in a moderate degree, they are broken up so far as they can be reached. This preliminary exploratory incision is insisted upon as an essential part of the technique, and as the means by which it is to be determined whether to conclude the operation by the vaginal route or to make an abdominal section. The condition of the proximal serous surfaces, the fundus of the uterus, the sacto-salpinx if it exists, and the ovaries, may thus be readily explored. If the cul-de-sac is obliterated by inflammatory adhesions, the latter may be broken up by passing the finger with its palmar surface to the uterus. The exploration of the true pelvis being completed, and fluid accumulations being evacuated, it is easy to determine whether or not to complete the operation. The radical operation being decided upon, the cervix is drawn downward and backward, a short-bladed retractor is introduced anteriorly, and the circum-cervical incision is completed with the scissors. The bladder is separated with the right index finger as high and as far to either side as possible. The uterus is then isolated before and behind from any neighbouring organs to which it may be attached. The neck is drawn down near the vulva, when, with scissors, the anterior wall is split from the cervix to the anterior peritoneal cul-de-sac. This now comes into view and is freely divided, after which the median semisection is carried to the fundus of the uterus. At this stage a loop of the intestine, of the omentum or the sigmoid, or sometimes of the vermiform appendix, may be found adherent to the uterus, or may be drawn down beneath the retractor. If this is found to be the case, the isolation of the fundus of the uterus is easily made under vision. The body of the uterus is easily everted, the cervix hanging over the fourchette. The appendages on both sides are now explored with the index finger and their extirpation can be undertaken, beginning upon either side, at the choice of the operator. It is well to begin by utilizing the index finger to break down any remaining adhesions, after which the tube and ovary may be readily drawn down by moderate traction, after being seized by the index and little fingers. If there are serous cysts, or if the purulent accumulations are too large, it is easy to evacuate them in the course of the manœuvres. It is exceptional when the extraction of the adnexa by this manipulation is not complete. A clamp is then applied above and below to each broad ligament; a smaller clamp being applied outside each larger clamp, to prevent the retraction of the pedicle. Care should be taken, in applying the small forceps, to seize the uterine and ovarian vessels respectively. Doyen removes the large clamps at the end of four hours and the smaller ones after ten hours. The sterilized gauze with which the vagina is packed up to the peritoneum, is permitted to remain *in situ* until the third or fourth day. Beginning on the fifth day, unless sooner indicated, vaginal injections are practised to the extent of five or six every twenty-four hours.

Modifications of Doyen's operation have been adopted by various operators. Péan commenced the operation by isolating the cervix from

the vaginal mucosa and by applying hemostatic forceps to the uterine arteries on each side. He divided the cervix bilaterally, thus forming an anterior and a posterior flap; these were then seized by a fresh grip of the volsella, by which progressive traction was exercised upon the uterus. As the organ was dragged down, the lateral tissues were seized by hemostatic forceps and the lateral incisions of the uterine wall were carried step by step to the fundus. The obvious objection to this method is the absence of the preliminary exploration practised by Doyen, and the use of a large number of useless clamps to encumber the field of operation and to render difficult that which ought to be easily accomplished. Pryor, who has done more than any one man to introduce the vaginal method of operation in America, has adopted several important innovations. He utilizes the procedure of Landau

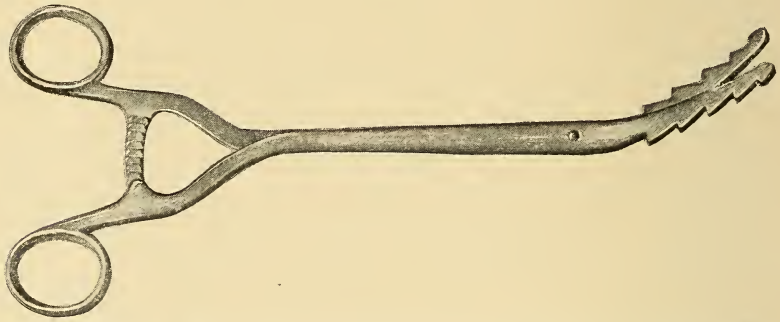

Fig. 238.—Pryor "has invented and employs a very valuable traction forceps."—Reed.

in making complete semisection of the uterus—i. e., dividing not only the anterior wall, as does Doyen, but the posterior wall also. He has invented and employs a very valuable intrauterine traction forceps (Fig. 238).

For splitting the uterus, he uses large curved grooved directors, one being passed above and behind the uterus anteriorly, and another posteriorly, care being taken that no fold of intestine or of omentum is caught between this director and the uterus. A probe-pointed, slightly curved bistoury is now used for dividing the uterus, the blunt point following the groove in the directors. First, one half of the uterus with its adnexa is drawn down, and the broad ligaments are secured by clamps, in the application of which great care is exercised. One clamp is applied to the upper margin of the broad ligament, and is locked with its point embracing about the upper half of the ligament, care being taken that the ovarian artery is included in its grip; the other forceps is applied to the lower half of the broad ligament, care being taken that the uterine artery is embraced within its grip. In this way the broad ligament folds upon itself without injury. The pelvis is now packed with sterilized gauze pads secured by strings with which to facilitate their removal. Le Bec ligates the pedicles and draws

them down into the vagina; and, in cases in which there is no probable remaining infection of the pelvic cavity, the ends of the broad ligaments are drawn together on the median line, thus closing the peritoneal cavity.

The *indications and limitations* of Doyen's operation should be understood. The *raison d'être* of the operation is the fact that the results following ablation of the appendages are not always satisfactory. This depends upon permanent changes in the muscularis of the uterus and in its lining membrane, causing the organ to be persistently painful after the removal of the diseased adnexa. In the presence of acute streptococcous infection of the uterus and the Fallopian tubes, the indications for complete ablation are positive; while in the presence of long-standing chronic infection of both the uterus and the tubes the indications are almost equally strong. In many cases belonging to the latter class, the uterus not only remains painful, but is a persistent *fons et origo* of a purulent discharge which can not be controlled even by repeated curettage. The result is a failure to restore the patient to health. The preservation of the now functionally useless womb is no argument against the operation. The procedure, however, has its limitations. Richelot, while personally preferring vaginal hysterectomy, recognises its limitations and practises abdominal panhysterectomy. Doyen says that abdominal section is indicated in the presence of large tumours of the adnexa and in the presence of probable tuberculous peritonitis. Pryor concludes that vaginal ablation should not be attempted through a vagina so narrow as to necessitate incision of the perineum, as practised by Segond. He also states that, in the presence of complicating intestinal lesions, the latter are to be recognised as the principal indication for intervention, which under these circumstances, should be done exclusively by abdominal section. He fails to state, however, just how these complications may always be recognised. The personal preference of the operator, and his familiarity with a given technique, must always be recognised, however, as a cogent reason for its employment.

CHAPTER XXXVI

MALFORMATIONS AND DISPLACEMENTS OF THE OVARIES

Malformations: Absence; rudimentary development; accessory ovaries; coexistence of ovaries and testicles—Displacements: Descensus; prolapsus; hernia.

Malformations of the Ovaries.—Since the ovary, like the testicle, begins its development at a higher level in the abdomino-pelvic cavity than that which it ultimately occupies, cases occur in which its descent has been arrested, and in which it is found, in the adult, above the plane of the pelvic brim. Since, further, the ovary, unlike the testicle, does not normally pass into the inguinal canal, it must be counted as a displacement when it is met with in that canal, or beyond it in the substance of the labium majus. The ovary, also, is liable to malformations by defect and by excess.

Absence of the Ovary.—Complete absence of both ovaries in an individual furnished with a uterus and external genital organs of the female type, must be regarded as an almost undemonstrated occurrence. For its demonstration, it would be necessary to examine post-mortem, not only the pelvic cavity, but also, and with great thoroughness, the abdominal cavity as well. Its occasional occurrence in grossly deformed fœtuses is, however, beyond doubt. The absence of one ovary is not so uncommon, and, when met with, is usually associated with defect of the corresponding Müllerian duct (absence of the Fallopian tube, uterus unicornis, and unilateral vagina), and sometimes with absence of the corresponding kidney (as in the case reported by Delagénière, *Progrès médical*, 2. s., vol. xx, p. 256, 1894).

Rudimentary State of the Ovary.—Although actual absence of the ovaries may be one of the extreme rarities of teratology, functional absence (i. e., their rudimentary state) is a well-established and not very uncommon maldevelopment. The glands may be so ill-developed, and may show such an approximation in their microscopical characters to the appearances seen in the earliest period in intrauterine life, that it may be difficult to decide from their examination alone whether they are ovaries or testicles. In form they may resemble the fœtal or infantile type, and they may be associated with the fœtal, the infantile, or the bicornate uterus. Further, they may coexist with other anomalies such as rudimentary tubes, stenosis of the aorta, and hypoplasia of more distant organs. Rudimentary development is also often combined with congenital displacement, which is indeed itself a form

of rudimentary development. If one ovary alone is in a rudimentary state, the anomaly may not appreciably influence the reproductive life-history of the individual in whom it exists; but if both glands are imperfect, the menstrual flow is either entirely absent, or is imperfectly established, there is defective hirsute development on the mons veneris, there is absolute sterility, and there is a condition of general infantilism with or without chlorosis and vascular hypoplasia. Cases have, however, been put on record, in which the rudimentary state of the ovaries has been associated with a normal development of the uterus and with all the signs of general bodily and mental vigour, and even with indications of sexual desire. The diagnosis of the anomalous condition of the genital glands may be made provisionally from a consideration of the symptoms, but with certainty only by means of a laparotomy. Manifestly, if it exists in association with rudimentary development of the uterus, it will be of little use to spend time and energy in therapeutical efforts directed against the latter organ. Where acute menstrual sufferings and marked nervous phenomena of the nature of epilepsy and insanity exist, it may be well to consider the question of removal of the rudimentary ovaries; but it by no means follows that the nervous manifestations will cease, for they can not always be regarded as consequences of the ovarian defect; indeed, they and the defect may quite possibly be the results of a common cause. Rudimentary ovaries may be due to arrested development during the embryonic period of intra-uterine life, or to peritonitis during the fœtal epoch, or to ovaritis from the supervention of one of the exanthemata in childhood.

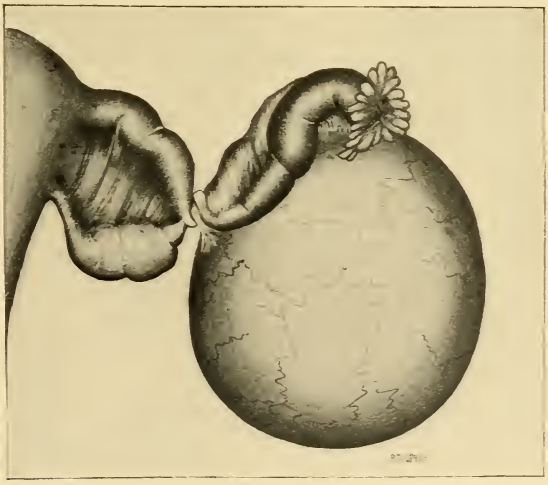

Fig. 239.—"'Constricted ovaries' are much less rare." (Dermoid cyst in constricted portion.)—Ballantyne (page 562).

Accessory Ovaries.—With the exception of the case of third ovary described by Winckel (*Lehrbuch*, p. 595, 1886), no genuine example of duplication of the female genital gland has been put on record, and even Winckel's case is in the opinion of Nagel (in Veit's *Handbuch der Gynäkologie*, Bd. i. p. 562, 1897) open to doubt by reason of the presence of gland ducts in the supposed ovarian body. On the other hand, accessory ovaries, or, as it is more correct, perhaps, to name them, "con-

stricted ovaries" (Fig. 239), are much less rare. One such ovarian fragment was seen by Ballantyne and Williams in a series of 61 consecutive autopsies on females dying in the Edinburgh Royal Infirmary; it was as large as a pea and was made up of ovarian stroma with Graafian follicles; it was attached to the anterior border of the right ovary by a stalk consisting partly of fibrous tissue with a covering of low cubical epithelium, and partly of solid columns of epithelial cells inclosed in the fibrous tissue; and it showed a cicatrix pointing to the dehiscence of a Graafian follicle at some time in the life of the individual. As many as three accessory ovaries have been found in one case, and an ovary has been noted divided into two almost equal parts. It is supposed that the constriction of the ovarian substance is produced by fœtal peritonitis. Clinically, accessory ovaries are of importance in explaining the want of success which sometimes follows removal of the ovaries performed in order to induce a premature menopause; they also offer an explanation of the occurrence of pregnancy after a double ovariotomy, and of the presence of three (or more) separate ovarian cystomata.

Coexistence of Ovaries and Testicles in the Same Individual.—The presence of one ovary and one testicle or of two ovaries and two testicles in the same individual, constitutes the anomalous condition described as true hermaphroditism. Of the *bilateral* form (that in which an ovary and testis are present upon both sides of the body), no absolutely conclusive example in the human subject has yet been recorded; the two-months' old, premature, and otherwise malformed infant described by Heppner (*Archiv für Anatomie, Physiologie, und wissenschaftliche Medicin*, p. 679, 1870) had a rudimentary uterus and a vagina, and, on both sides, a normal ovary, parovarium, and tube, and near to each ovary was a body resembling a testis and containing tubules running toward the hilum; but whether the last-named bodies were really testicles, is a hard question to settle, especially as the drawings are unsatisfactory. *Lateral* hermaphroditism, which may be defined as the presence of an ovary on one side and a testis on the other, has been met with in a few cases, of which those reported by Obolonsky (*Zeitschrift für Heilkunde*, vol. ix, p. 211, 1888) and Schmorl (*Archiv für pathologische Anatomie und Physiologie*, etc., vol. cxiii, p. 229, 1888) are the most clearly established. In Schmori's patient, an individual twenty-two years of age, there was hypospadias, which was successfuly operated upon; a swelling appeared in the groin, which was regarded as a degenerate testis and was excised, but death occurred. At the autopsy, it was found that the body in the left groin was an ovary, there was a uterus bicornis, and, on the right side in the scrotum was a testis with a rudimentary epididymis. Blacker and Lawrence (*Transactions of the Obstetrical Society of London*, vol. xxxviii, p. 265, 1896) have described what is apparently the only genuine case of *unilateral* hermaphroditism (ovary *or* testis on one side, with ovary *and* testis on the other) in the human subject. The case was that of a fœtus, other-

wise well formed, in which was found a uterus unicornis, a normal ovary and tube on the right side, and on the left side an ovo-testis, with a vas deferens and epididymis. The left gland (ovo-testis) in one part showed cell columns, cell nests, and Graafian follicles with a large quantity of stroma (ovarian portion); and in a second part exhibited an abundant stroma, with definite tubules filled with cells, and forming at the hilum a retelike structure (testicular portion). It may, therefore, be accepted that the occurrence of what may be termed anatomic hermaphroditism in the human subject has been demonstrated—that is to say, in one individual genital glands have been found, one of which had a structure which could be justly called ovarian, while the other showed appearances warranting the conclusion that it was testicular in nature. No case, however, has yet been met with in which functional hermaphroditism was present—that is to say, no individual has ever been known to possess two kinds of genital glands both showing functional activity. It is extremely doubtful whether any such association ever will be demonstrated.

Displacements of the ovaries are of frequent occurrence. They may exist in any degree from a slight *descensus* to a complete *prolapsus*, or even a *hernia*.

The anatomical connections and relations of the ovary render it difficult to determine the precise normal locus of the organ; attached, as it is, by the ovarian ligament, and resting, as it does, on the fold of the broad ligament, it enjoys normally a considerable range of mobility. This seems to be a wise provision of Nature whereby the sensitive organ is enabled to evade what would otherwise be painful pressure from neighbouring structures, such as the uterus, the cæcum, the sigmoid, and even the overloaded bladder. The ligamentum ovarii proprium is firm and round, consisting of fibro-muscular elements, is covered by peritoneum, has a length of about 2.6 centimetres, and is essentially inelastic; while the duplicatures of peritoneum, which comprise the remaining suspensory apparatus of the ovary and permit that organ to ascend with the fundus uteri during pregnancy, are highly elastic. It is to be seen, therefore, that, to an important extent, the position of the uterus determines the position of the ovary. The ovary moves with the uterus and, to some extent, independently of it.

Descensus and Prolapsus.—When these variations of position occur, however, they do not involve the establishment of either traction or pressure upon the organ whereby its circulation becomes mechanically disturbed, nor is the ovary prevented from returning within what may be recognised as its normal bounds and limits. There are cases, however, in which the organ is forced into a distinctly abnormal position. Thus, it is occasionally found posterior to the uterus and riding upon the utero-sacral fold of the peritoneum; in other instances it gravitates into the cul-de-sac, often becoming adherent (Fig. 240); in a few cases it has been found adherent between the uterus and

the bladder, while in still other cases it has been found adherent to the intestines and drawn by them well above the brim of the pelvis.

Uterine fibromata are frequent causes of ovarian displacement, the organ often becoming diseased in consequence of repeated traumatisms inflicted by the neoplasm.

Fig. 240.—". . . It gravitates into the cul-de-sac, often becoming adherent."—Reed (page 563).

The *symptoms* of prolapsus uteri include pain, which is generally referred to the normal locus of the organ without reference to its displaced position; and, generally, nervous reflexes of the most vague and indefinite character, with a tendency to increase in complexity and seriousness. The *diagnosis*, however, must rest upon careful physical exploration, under anæsthesia if necessary.

The *treatment* should be addressed primarily to any recognised causal condition; thus, in the presence of a retro-deviation of the uterus, that condition is to be remedied before attention is given to the displacement of the ovary. If the cure of the causal condition does not result in relief of the remaining symptom and in restitution of the ovary to its normal position, surgical treatment should be addressed to the ovary itself. It may be stated as a rule to which there are but few exceptions, that an ovary which has acquired the habit of descensus can be made to remain in its normal position only by means of surgical fixation. This may be done in many cases by shortening the round ligament by Alexander's, or preferably by Mann's, method. If the latter operation is selected, a suture may easily be passed through the utero-ovarian ligament, by which the ovary may be anchored in its normal position. The ovary itself should not be injured, even in a surgical way, unless it is the seat of disease.

Hernia of the ovary is of occasional occurrence; it may exist at birth, or it may develop in old age; and it generally consists in a descent of the organ through the canal of Nuck, which persists in

many cases. It is encountered clinically as an inguinal hernia. Mencière has reported 4 cases of hernia of the ovary occurring in children and has been able to find 7 others on record. All 11 were inguinal, 9 were on the left, and 2 on the right side, and in one instance the uterus, as well as both tubes and ovaries, lay in the sac.

Browne, after a careful study of hernia of the ovary, concluded that the condition was of more frequent occurrence than was generally supposed. He attributes congenital hernia of the ovary chiefly to arrest of development during intrauterine life; and finds that it is always inguinal, often double, and when single, generally on the left side. The formation of this condition is favoured by the persistence of the canal of Nuck and by the size and shape of the ovary, which is at first a long flat body with its apex pointing toward the canal.

The fact that, at birth, the ovaries are situated above the iliopectineal line, and descend during the first few months into the true pelvis, is also recognised as a contributory causal circumstance.

Hernia of the ovary is generally associated with corresponding descent of the Fallopian tubes, and, as in Mencière's case, the uterus, too, may be found in the sac. Acquired hernia, on the other hand, is not always inguinal, but may occur through any ordinary hernial opening. The condition generally occurs with pre-existing intestinal or omental hernia. The condition is generally unilateral, occurring more frequently on the right side. Labour and the postparturient relaxation of the tissues are recognised as the chief causes.

The *symptoms* of ovarian hernia may be confusing from the fact that omentum or intestine may be present in the sac. In the congenital form, this complication is less likely to occur. In such cases, the hernia exists as a small painful nodule, lying at the orifice of the inguinal canal. In consequence of the contraction of the tissues after the descent of the organ, the hernia is generally irreducible, any effort to push the tumour back being the cause of extreme and depressing pain, which may produce symptoms of shock. The absence of crepitus in the tumour, and of the usual reflex intestinal symptoms, indicates that the bowel is not involved in the protrusion. The tumour may, however, be the seat of important changes, induced either by strangulation, or by organic degeneration of the ovary. In the acquired form of hernia, the intestine and omentum are more liable to be found in the hernial sac, which, as already intimated, does not always protrude through the inguinal canal. One of the most perplexing forms of hernia of the ovary is that in which the protrusion occurs through the obturator canal. Von Rogner Gusenthal describes a case in a patient sixty-six years old. There were symptoms of strangulation, with pain and indistinct gurgling, but no distinct tumour, in the right groin; femoral hernia was diagnosticated. On operation, the crural canal was clear, but a bulging was seen under the pectineus muscle. The muscle was divided and the sac of the hernia, in a gangrenous condi-

tion, bulged forward. This contained the right ovary and tube, and a coil of intestine, all gangrenous.

The *treatment* of these cases consists in incising the hernial sac and extirpating the ovary, which will generally be found to have undergone such morbid changes as to render its return to the peritoneal cavity unjustifiable. In infantile cases, however, the organ may be saved in many instances. In 11 cases collected by Mencière, cure resulted in 10; in 8 by radical operation, in 2 by reduction and bandaging.

CHAPTER XXXVII

INFECTIONS AND INFLAMMATIONS OF THE OVARIES

Classification: Hyperæmia; acute inflammation; chronic inflammation—Bacteria of the ovaries—Individual infections: Streptococcous infection; gonococcous infection; pneumococcous infection; *Bacillus coli communis* infection; unusual bacterial infections; tuberculosis.

The classification and description of the inflammatory lesions of the ovary presents many difficulties, because, first, of a confusing nomenclature; and, secondly, the ovary can scarcely be said to stand alone in its pathologic lesions, since its close association with the other organs of the pelvis, anatomically and physiologically, makes its lesions in a vast majority of cases only a part of a pathological picture.

A primary statement in this chapter must correspond with that on inflammatory lesions of the Fallopian tubes, to the effect that *all inflammatory* lesions of the ovary are due to bacterial infections. Only after such a dogmatic and sweeping statement may we qualify it by saying that malpositions, irritations, strangulations or new growths, may produce hyperæmias and subsequent changes in the tissues, which are very closely related to those changes brought about by a long-continued action of the less virulent germs. In other words, the class containing the cases of greatest number and clinical importance is the bacterial, and the minor class is that which depends upon mechanical causes.

Hyperæmia of the ovary is a physiologic condition during menstruation (see Menstruation), sexual excitement, and pregnancy. In this connection, however, we consider only those hyperæmias which overstep the physiologic limitations. This is exemplified, for example, in a case in which there exists a malposition of the ovary with twist of the mesovarium, thus interfering with the venous circulation; it is also shown in the case of prostitutes who are subjected to excessive natural or unnatural sexual excitement; also, inflammation in other pelvic organs and pressure from neighbouring tumours and pessaries, are among the recognised causes of this persistent excess of blood in the ovary. Bacterial toxines, or the germs themselves, may induce a hyperæmia from which the essential phenomena of inflammation are absent. A hyperæmia of this class is easily transformed into an active inflammation through the influence of infection by even the less

virulent bacteria. The excessive blood supply may continue to increase, until, by sheer force of mechanical pressure, there occurs transudation of the liquor sanguinis and migration of the leucocytes. A hyperæmia may thus become transformed into an inflammation. The organization of the transuded elements constitutes a true hyperplasia, while, as a result of the persistent excessive nutrient supply, pre-existing histologic elements may become enlarged, thus establishing a true hypertrophy. In any event, the change in the stroma is such as to render it unyielding to the premenstrual blood pressure, this condition inducing extreme pain during the few days preceding the onset of the monthly flow. A passive hyperæmia of the character herein described exhibits, on microscopic examination, dilated, normal vessels, well filled with blood, the walls of the blood vessels thickened, and sometimes thrown into folds which project into the lumen. In some cases, the walls of the vessels have been found to be the seat of hyaline degeneration. In other cases, however, marked perivascular changes are noted; the stroma of the ovary may show a round-celled infiltration, and, as already indicated, a decided hyperplasia.

The walls of the follicles may yield to the blood pressure, the follicles themselves becoming the seat of slight hemorrhages, and their walls, when cut and mounted, giving the appearance of minute punctate hemorrhages. The hypertrophic changes in the stroma itself may interfere with the spontaneous rupture of the follicles, which, as a result, undergo degeneration. The most frequent consequence of hyperæmia of the ovary is that form of hemorrhage known as hematoma. (See Hematoma of the Ovary.)

The prognosis of hyperæmia of the ovary is favourable in its early stages and before it has resulted in marked trophic changes in the organ itself. When these changes have occurred, however, the condition becomes essentially progressive. The treatment in the early stages may be said to be confined to efforts to remove the causative condition; this once accomplished, the hyperæmia itself will subside. In the later stages, however, when the ovary has become the seat of hyperplastic and hypertrophic changes, and, particularly, when the follicles have undergone degeneration, the condition is irremediable by any other means than ablation of the organ. (See Oöphorectomy.)

Acute inflammation of the ovary manifesting, in all of their intensity, the phenomena of vascular engorgement, circulatory stasis, tissue infiltration, and the migration of corpuscles, and resulting in suppuration, always depends upon infection. The same may be said of those inflammations of the ovaries that do not result in the destruction of tissue—for it is to be remembered that ovarian tissue, like other tissues, has the power within certain limits of resisting invasion by micro-organisms, although the defensive effort induced by the presence of the germs may be productive of all the essential phenomena, short of suppuration itself. The resulting changes in the tissues may be more or less permanent, manifesting themselves in increased density

of the stroma, in permanent enlargement of previously distended blood vessels, and in organization of the inflammatory products.

Acute oöphoritis is usually the result of streptococcous infection. The ovary is swollen, soft, and of elastic consistence, the blood vessels are strongly injected, the stroma is infiltrated by serum and pus, and the surface of the organ is the seat of a general peritonitis which is accompanied by a deposit of fibrin, a pseudomembrane, and pus. The stroma is filled by minute abscesses, and is indurated; the undeveloped follicles are highly infiltrated by small round cells, and the more mature follicles lose their epithelium and are transformed into pus sacs. The sheaths of the blood vessels are infiltrated by small round cells. This condition may continue, to the complete destruction of the ovarian stroma by a fusion of abscesses; or, with the subsidence of the inflammation, the ovary may return to its normal size, but be left indurated and bound down by adhesions, and rarely retaining a functional value. A corpus luteum is apt to serve as a focus of especial activity and early abscess formation.

The gonorrhœal infections may undoubtedly produce an acute oöphoritis (Wertheim, Menge) but the lesions are usually confined to the surface of the ovary. Abundant adhesions are formed. The follicular contents become turbid and almost purulent, or they may be blood-tinged. There is an infiltration and thickening of the stroma by small round cells—a lesion which has a considerable importance in the explanation of follicular cyst the result of a toughened follicular capsule.

Chronic inflammation of the ovarian tissue manifests itself primarily in a proliferative activity in the stroma, which leads to an infiltration by small round cells and the deposit of new connective tissue. The blood vessels will be somewhat dilated and their sheaths infiltrated by small round cells. The parenchyma or Graafian follicle will be unchanged in the early forms, but the gradually increasing deposit of firm fibrous tissue in both the connective tissue and muscular elements of the stroma, presses on, and will cut off, more and more, the nutrition of the follicle, to a degree of destruction which may range from the mildest interference to a complete obliteration of all specific ovarian elements. This connective-tissue change may, however, be limited to the surface of the organ, and, even though the Graafian follicle persists, it is rendered functionless by the complete encasing shell of the albuginea. Such ovaries may be larger than normal, cystic, and presenting a smooth surface; or the interstitial connective tissue may contract after its formation to give an organ which—smaller than usual—has a roughened and distorted surface, and is in reality a dense, new, interstitial connective-tissue ball. In the latter type of inflammation, the Graafian follicle is usually entirely absent, and the arteries are tortuous and have much thickened walls. In those types which present enlargement, many of the Graafian follicles are transformed into cysts of varying size and the vessels are widely dilated, especially the veins.

Chronic oöphoritis is usually preceded by an acute inflammation, but may gradually develop as the result of long-continued mechanical irritation or obstruction in the blood flow. The morbid changes present a variety which has led to the designation of several classes of chronic oöphoritis; but the divisions scarcely seem to be justified on a comprehensive study of chronic inflammations of this organ.

Bacteria of the Ovaries.—It can hardly be said that, as yet, there is any bacteriology of the ovaries as distinct from the facts and considerations already brought forward in reference to the Fallopian tubes. Yet the mode of entrance and the resulting pathologic lesions vary with the variety of germ present, to a degree that makes a rather detailed study of the bacteria concerned in ovarian infections necessary.

The anatomic structure of the ovary, the peculiar physiologic activity as expressed in a periodic congestion and the rupture of a Graafian follicle, the liability to the development of new growth, and the tendency to torsion of the ovarian pedicle, lay the ovary open to invasion by bacteria in a way from which even the tubes are to some extent free. Furthermore, we must class, as predisposing causes, almost every inflammatory condition of the female genital tract, a statement given its greatest force by a mere reference to the extreme frequency of the tubo-ovarian abscess in gynecological practice, which shows that the tubes and ovaries are often subject to the same bacterial ravages. This fact is further borne out by the statistics of Martin, which show that out of 4,948 polyclinic ovarian patients, 1,464 suffered from subacute or chronic endometritis, and 834 from chronic metritis. Yet another causative factor is found in the fact that when new growths of the ovary, belonging to the class of cystoma, undergo changes such as result from torsion of the pedicle, they are liable to the inroads of the *Bacillus coli communis* and of saprogenic saprophytes, from adhesion to the intestines. Considering our theories of invasion, it must be held to be a remarkable thing that the occurrence of abscess in a cystic ovarian tumour is so rare, yet, follicular abscess the result of bacterial infection is much more common. This fact may be due to the open wound produced by the rupture of a follicle giving an easy entrance into the ovarian tissue to the pathogenic organism, thus forming a point of departure for further inroads.

The *modes of entrance* of bacteria to the ovary are, in general, identical with those already discussed under the head of infections of the Fallopian tube. These channels are: First, the lymphatics and blood vessels which establish a *direct* line of transmission from the external genitalia, and the mucosa of the vagina and uterus, to the ovary. (See Tuberculosis of the Fallopian Tubes.) This is specified as the channel of preference for all bacteria except the gonococcus. Secondly: The female genital tube connects the surface of the ovary with the external air, and any infection may traverse this distance from the surface of the body (practically from the vagina) to the surface of the ovary, to

cause an inflammation. This is specified as the channel of preference for the gonococcus. Thirdly: It has been clearly demonstrated that bacteria may pass through the wall of the intestine (especially at a point of ulceration), gravitate to the pelvis, and cause infection of the ovary (Grawitz, Stoecklin), or that bacteria may pass from the intestines through adhesions which bind them to it. This will be specified as the channel through which the *Bacillus coli communis* usually passes.

A study of the specific characteristics of each type of infection, and their relation to each other, will be best carried out by considering separately the most important of the bacteria that may cause ovarian disease. Yet, this treatment of the subject is only possible after a very positive statement already made (see Fallopian Tubes) to the effect that every infection in the genital tract *is a mixed infection.*

Individual Infections of the Ovaries.—Streptococcous infection of the ovaries is of frequent occurrence. These bacteria reach the ovaries through the avenues of the lymphatics and blood vessels, by which they are distributed directly to the parenchyma and inaugurate their activities by the development of small miliary abscesses. A section of ovarian stroma will show a small abscess cavity the pus of which abounds in streptococci, and the surrounding stroma will be studded with migrated leucocytes (Fig. 241). Sooner or later, small segments of ovarian tissue become detached and are found in the pus of the gradually enlarging abscess cavity. Such detached segments of tissue will show it to be studded with streptococci (Fig. 242). These abscesses may develop at any point from the centre to the circumference of the ovary, even in its wall. They form irregular cavities, and are consequently liable to be mistaken for purulent cysts. In many cases, however, there is no difficulty in establishing their real character. Several foci of suppuration may be simultaneously established, resulting in the coalescence of their cavities and the consequent development of one relatively large abscess. An ovary that is the seat of this form of infection is very liable to become adherent to its neighbouring Fallopian tube. A remnant of necrotic partition may be observed in some cases between coalescing pus cavities (Fig. 243). The suppurat-

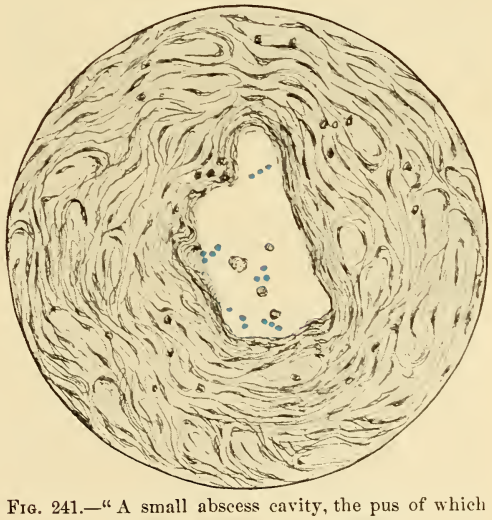

Fig. 241.—"A small abscess cavity, the pus of which abounds in streptococci."—Reed.

ing cavity in the ovary, however, is generally separated from the purulent accumulation within the tube by a barrier of formed tissue, which may itself be the field of more or less diffuse infection by the streptococcus, and melt down to form a wide communication between the tubal and ovarian abscess cavity. A streptococcous infection of the ovary may, however, result in abscess of that organ to its complete destruction, without the formation of pus in the tubes, and with the tissue between the two entirely intact (Fig. 244).

Fig. 242.—"Detached segments of tissue will show it to be studded with streptococci." —Reed (page 571).

In studying the pathology of infection of the ovaries by the streptococcus, it is important to bear in mind the antecedent chain of morbid events. The infection having occurred primarily through some traumatism or abrasion in the uterus, generally in connection with parturition or the puerperium, the micro-organisms may manifest their activity in the uterine muscularis; or they may find their way through the lymphatics into the surrounding cellular tissue; or they may continue their journey and invade the adnexa. The invasion may be arrested at any one of these three stages, or a given case

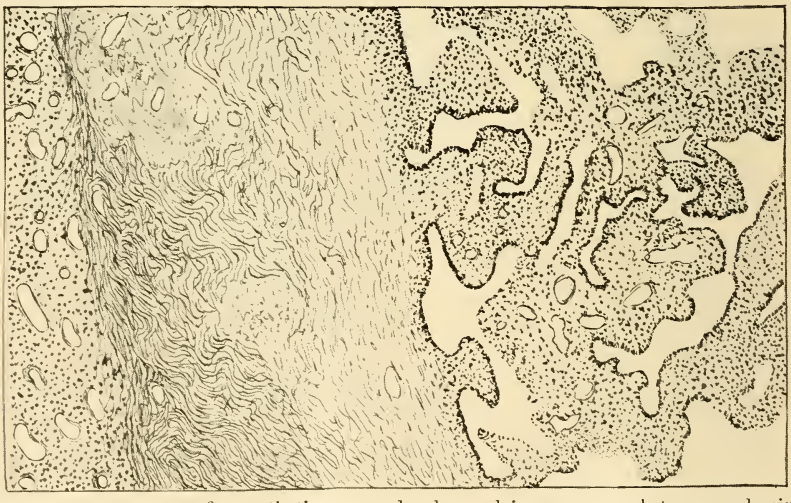

Fig. 243.—"A remnant of necrotic tissue may be observed in some cases between coalescing pus cavities."—Reed (page 571).

may exemplify all three of the stages, and this, occasionally, with such rapidity, that they may appear to be coincident. The virulence of the micro-organisms and the susceptibility of the patient are the two factors which determine the clinical conduct of the infection at the various stages of its invasion. Thus, an infection of the uterine wall may be arrested, either spontaneously or by treatment, and resolution may follow; or active suppuration may develop. A similar infection of the circumuterine tissues may have a similarly variable course and the same may be true of the appendages. The interval between either of these progressive stages of invasion may be of variable length. It thus happens that the streptococcous infection of the uterine appendages may develop remotely in point of time from the original infection; or it may be practically a simultaneous occurrence. In any event, the history of the case and the revelations of histological examination will alike show that the invasion has taken place through one or the other, or both, of the circulatory media.

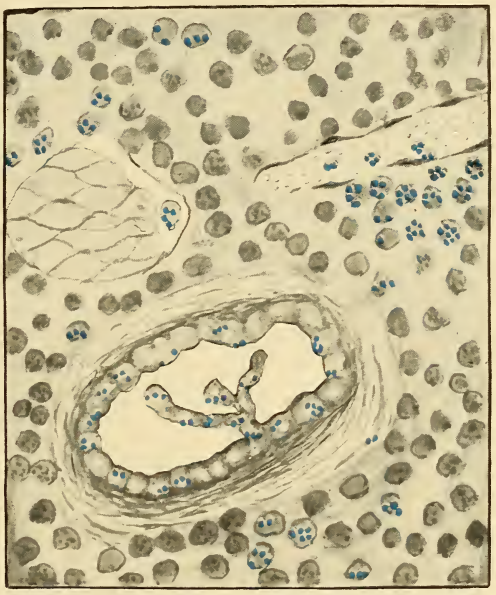

Fig. 244.—"A streptococcous infection of the ovary may result in abscess of that organ to its complete destruction."—Reed (page 572).

It is entirely apparent that the ovarian lesion is only a part of the clinical picture presented by such a streptococcous infection. The lesions in the uterus and the Fallopian tubes have been previously described; yet it seems desirable to call attention at this point to the severe "perioöphoritis" that occurs in these cases. A variable degree of peritonitis is always set up which results in the destruction of the peritoneum, in large deposits of fibrin, and in adhesions that bind down the ovary to surrounding organs, until it is so completely covered in, that its liberation becomes one of the most difficult operations of the surgeon, and can only be accomplished by actual dissection, which leaves a raw cavity. In fact, the symptoms from which the patient suffers after the subsidence of a pelvic peritonitis, are explained almost wholly by this perioöphoritis with the accompanying adhesions. Indeed, this part of the ovarian lesion has led to a distinct classification

by some authors as " adherent and bound-down ovaries," and this diagnosis will be found in many case books as the indication for operation.

Gonococcous infection of the ovaries is of relatively the most frequent occurrence. The inflammation in these cases manifests itself primarily upon the surface of the organ. This is accounted for by the fact that, in at least a vast majority of cases if not in all, infection of the upper genitalia by the gonococcus occurs by the progressive invasion of contiguous mucous surfaces. In this way, the infection travels from the vagina through the endometrium, through the tubal mucosa, until it reaches the surface of the ovary. Here, it becomes the exciting cause of an inflammation which is manifested more distinctly in the enveloping tunic (perioöphoritis), than in the deep stroma (parenchymatous oöphoritis). Yet, a moment's reflection upon the anatomy will show that the division of the inflammation of that organ into superficial and interstitial can not be justified, as neither the cellular nor the circulatory arrangement of the ovary will permit a definite limitation of the inflammation to either one or the other structure. It is a fact of ordinary observation, however, stoutly affirmed by Reymond, that the gonococcus attacks the surface of the ovary and is never demonstrable in the pus of an ovarian abscess; nor has he ever seen the cyst of an ovary become purulent in the presence, or in consequence, of gonorrhœal salpingitis. He has, however, observed as the result of gonorrhœal contamination of the surface of the ovary, peripheral sclerosis and the formation of numerous follicular cysts beneath the sclerotic envelope. It is precisely the development of this sclerosis in the peripheral layer of the ovary that prevents the rupture, and causes the subsequent degeneration, of the gradually maturing Graafian follicles. (See Small Cysts of the Ovary.)

It must be further stated, however, that even though the above represents the usual conditions, a transmission of the gonococcus by contiguity and passage through the tissues, and its transfer by the blood and lymphatic vessels, are not only possibilities, but are held by Luther and Wertheim to be frequent. A mixed infection in gonorrhœa is, perhaps, the rule, and any reasoning concerning the course of the transfer must be qualified by this possibility.

The inflammatory reaction of the neighbouring peritoneum, and the production of adhesions in a gonorrhœal inflammation of the ovaries, will be very similar in their nature to the processes caused by the streptococcous infection, and will vary with both the intensity of primary infection and the duration of its action.

Pneumococcous infection of the ovaries, although rare, is on record. Von Rosthorn, Zweifel, Frommel, and Witte, have each reported cases in which this micro-organism was demonstrated in the pus of an ovarian abscess. In each instance, it occurred independently of either pneumonia or pulmonary tuberculosis. Microscopical sections showed the abscess wall to contain numerous pneumococci, mingled with broken-down tube wall and ovarian tissue. Both inoculation and

tube cultures yielded the pure micro-organism. It would seem that, in its manner of invasion, and in its effects upon the ovarian tissues, the pneumococcus differs from the streptococcus (see Pneumococcous Infection of the Fallopian Tubes) in these points, viz.: First, it may enter by way of the general circulation; secondly, there is a remarkably severe invasion of the peritoneum as shown by the severe adhesions; thirdly, the macroscopical appearance of the pus, which is thick and very tenacious, and resembles that seen in empyema following pneumonia caused by the *Micrococcus lanceolatus*; and fourthly, the fatal cases of Frommel and Witte speak of a very high degree of virulence.

Martin suggests the possibility of a diagnosis in the absence of a history of labour at term or interrupted, a gonorrhœal infection, and in the presence of an evident severe perimetritis.

The **Bacillus coli communis** is a well-established cause of ovarian abscess in a small percentage of cases. It is a significant fact in connection with the mode of infection, that a colon-bacillus infection never occurs except in an ovary which has previously been adherent to the bowel. It would be rash to declare that the other channels may not serve as the means of transfer for this germ, but such has not been observed. The bacteria are found entirely in the pus and on the surface of the abscess wall. The main characteristic of such a bacterial invasion is the supervention of acute constitutional and local symptoms upon a previous pelvic inflammation.

The **unusual bacteria found in ovarian abscesses** are actinomyces, described by Zemann; the bacillus of malignant œdema by Witte and others; the *Bacillus proteus Zenkeri* by Robb; and inoffensive saprophytic bacteria by many observers.

Tuberculosis of the Ovary.—Many of the older writers, including Virchow and Rokitansky, have stated that tuberculous oöphoritis is of such rare occurrence, even if it ever occurs, that its consideration is useless. At the present day, however, we know that it is a relatively frequent disease of the ovaries, that it may be either primary or secondary, and that it deserves practical attention on the part of the gynecologist. As before mentioned, the order of frequency with which tuberculous disease of the female genital organs occurs in various locations is, tubes, uterus, ovaries, vagina, cervix, and vulva. Schöttlander has collected 153 cases of reported tuberculous oöphoritis, but accepts only 30 of these, in which a microscopic examination was reported. He admits that many of those in which the microscopic examination was not made, were undoubtedly tuberculous, yet thinks they can not have a scientific value. It is only since the advent of the means for exact research, and the cultivation of routine methods of examining all material obtained from the autopsy table or the operating room, that the frequency of this condition has been demonstrated. Such methods have made it clear that ovaries showing no macroscopical change may yet contain numerous miliary tubercles (Wolff, Schöttlander, Franqué).

The mode of infection by the tubercle bacillus is variously explained by authors. Klebs believes that the tube is the usual source of infection, and that the infection is transmitted in continuity of tissue, rather than by means of the blood. Others believe that the blood is the most probable carrier of the tubercle bacilli (Mosler, Guillemain), yet Jani and Westermeyer-Jäcksch have failed to find the tubercle bacillus in the apparently healthy ovaries of a series of phthisical patients, and the latter investigators obtained a positive result in only one case, by the inoculation of the peritoneum of animals by such ovaries. Schöttlander believes that the peritoneum is the usual source of infection, yet accepts a tubal origin, and believes that the bacteria may often enter by an abrasion in the vagina or vulva, and ascend to the ovary by way of the lymphatics without a lesion at the point of inoculation. Franqué has directly traced such an infection from an abrasion in the vault of the vagina. A primary localization of the tubercle bacillus in the ovary is extremely rare. Jacobs has reported such a case of one-sided tuberculosis of the ovary, where the Fallopian tube showed only an interstitial inflammation and the lungs were certainly only involved after the operation. Cases in which the process is primary in the genital tract are not so rare (Franqué, Schöttlander, and others).

Morbid Anatomy.—The anatomical changes characteristic of ovarian tuberculosis are the formation, in the majority of cases, of smaller or larger caseous foci, while the merely miliary form is seldom met with. Along with these changes, there is usually present in the organ an inflammatory condition of a more specific character, which results particularly in an atrophying process in the follicle. The caseous masses vary in size from that of a millet seed to that of a marble, may run together to form apple-sized cavities in which almost all ovarian tissue is destroyed, or, as has occurred in certain reported cases, the ovarian nature of the huge abscess cavity may be difficult of demonstration. Besides these changes, there exists a simultaneous adhesive tuberculous pelviperitonitis of varying degree. Heiberg has often found a formation of small caseous foci in the dilated follicle, closely resembling a degenerated rupture follicle, yet the process seems to localize by preference in the stroma. This fact has been demonstrated as the rule in the collected cases, and has been further demonstrated by the experiments of Acconci, in which the injection of a pure culture of tubercle bacilli into the ovary always resulted in an interstitial deposit of tubercles, but never so when into the follicle. Schöttlander has observed follicle tuberculosis, however, in rabbits.

It is a well-established fact that a miliary tuberculosis may exist in the apparently healthy ovary of tuberculous women (Schöttlander). H. J. Whitacre has observed a perfect Graafian follicle in the midst of ovarian stroma which was in a state of complete tuberculous infiltration (Fig. 245). The miliary tubercles are usually found in the superficial zone of the ovarian tissue, but sometimes find their way deeper, and always possess the usual characteristics of epithelioid, giant, and

round-celled tubercles, but the tubercle bacilli are seldom found. Whitacre and Wolff have noted the appearance of considerable numbers of very large giant cells, completely alone and apart from other tuberculous products, in the stroma of the organ (Fig. 246). Schöttlander has called attention to the fact that the normal follicle, especially when cut just to one side of the ovum, will give rise to a collection of cells that very much resemble a miliary tubercle. The same confusion may also arise from an atrophied follicle. Frerichs has further stated that caseous foci in the ovary are not necessarily of tuberculous origin. It becomes apparent that this confusing feature in the usual histological picture (Fig. 247) of tuberculosis, when associated with the extreme difficulty encountered in demonstrating the tubercle bacillus, will render even a microscopic diagnosis difficult.

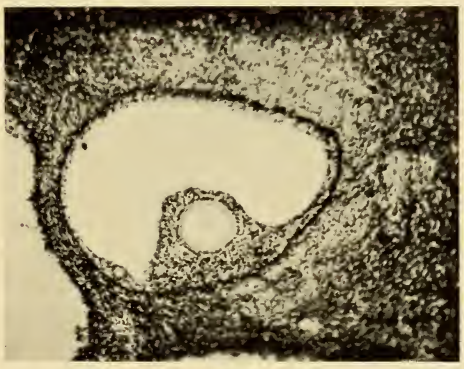

Fig. 245.—"A perfect Graafian follicle in the midst of ovarian stroma which was in a state of complete tuberculous infiltration."—Whitacre (page 576).

Fig. 246.—"Whitacre and Wolff have noted the appearance of very large giant cells."—Whitacre.

The *symptoms* of the disease vary with the extent of the involvement both of the ovary and of the peritoneum. The miliary form of the disease will give *no* symptoms, while the more advanced caseous forms may give rise to the most severe symptoms of pelvic abscess.

The *diagnosis* of the condition possesses a scientific rather than a practical interest, since it is impossible to recognise the earlier forms by any known means, and the later forms are either associated with disease of other organs, or are operated on under a

mistaken diagnosis. Martin states that we may diagnosticate a tuberculosis of the ovary when the tube end is not enlarged but the ovary is represented by a tumour the size of a goose's egg, which is glued to the side of the uterus and only slightly sensitive. Hegar considers the gluing of the tumour to the uterine ligament, as in parametritis, a characteristic feature. That mistakes can be made, even in the *microscopic* examination, is certain (Madlener), yet the appearance of perfectly typical miliary tubercles in some part of the structure is the rule, and the regular arrangement of the epithelial cells of a follicle with cement substance between them, will usually serve to give a correct diagnosis. Again, the presence of giant cells does not remove every difficulty of diagnosis, since an egg follicle with a moderately thick epithelial layer, and filled by granular material, my resemble greatly the giant cells of tuberculosis. Yet, in giant cells, the nuclei are less regularly arranged than in a follicle, and the long axis of the nucleus is tangential in the follicle and radial in the giant cell. It becomes apparent that a thorough microscopic examination is an unavoidable necessity.

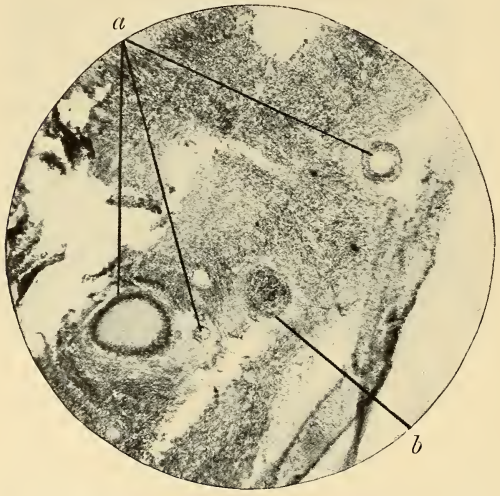

FIG. 247.—"The usual histological picture of tuberculosis." *a*, Graafian follicles; *b*, circumscribed collection of epithelioid cells containing bodies that appear to be giant cells; yet this is not a miliary tubercle, but a Graafian follicle.—WHITACRE (page 577).

Treatment.—The treatment of ovarian tuberculosis will be almost exactly that of the tubal type, and will depend upon much the same reasoning with reference to the general condition of the patient. One of the unexplained results of abdominal surgery is the almost constant recovery of cases of tuberculous peritonitis, following even exploratory incision of the abdominal cavity. These cases, even when associated with extreme ascites, appear to undergo resolution, following the opening and irrigation of the peritoneal cavity. Reed has cases alive and well seven years after operation, the peritoneum at the time of operation being thoroughly studded with tuberculous deposits.

CHAPTER XXXVIII

TREATMENT OF INFECTIONS OF THE OVARIES

Preliminary considerations — Natural terminations — Palliative treatment — Conservative treatment—Radical treatment: Oöphorectomy, indications; unilateral—Effects: Primary, secondary.

The treatment of infections of the ovaries can not be discussed intelligently without taking into consideration the coincidence of similar infections of the Fallopian tubes and, frequently, of the pelvic lymphatics. The former of these complications has already been discussed (see Infections of the Fallopian Tubes), while the latter will be presented in a subsequent chapter. (See Infections of the Pelvic Lymphatics.) The ovary, however, presents special points for consideration when it is looked upon as the organ of ovulation, and when its unique morphology is taken into account. Its removal or complete organic destruction, when occurring on both sides, implies irremediable sterility, the exceptional cases of fecundity following oöphorectomy not being worthy of consideration as exceptions. The preservation of the ovaries or of their function, in all cases in which reproduction is desirable, is, therefore, a matter for primary consideration after the preservation of the patient's life has been assured. It goes without saying, that treatment should have for its object the preservation of these organs, when this can be accomplished with safety to the patient's health or life. When surgical intervention should take place, as also its extent, must be determined by a knowledge of the natural history of the morbid changes induced by infections.

The natural termination of infections of the ovaries depends largely upon the character and virulence of the preponderating micro-organism in the individual case. *Streptococcous and pneumococcous infections* are more dangerous to life than those depending upon the gonococcus. The primary danger to life from these infections has, probably, been exaggerated. This fact was emphasized by Chrobak (*La Semaine médicale*), who stated in 1893 that the statistics of the Anatomico-Pathological Institute of the General Hospital of Vienna showed that there had been but 14 deaths from inflammatory diseases of the uterine adnexa in about 42,000 cases of that affection, although Schauta thought that they were of more frequent occurrence, since he, himself, had seen 4 deaths from pyosalpinx in a single year. It is highly prob-

able that these infections, taken as they come, if left to themselves would yield a much higher mortality than that indicated by either of these observers; but even granting this to be true, it does not follow that infection of the appendages is the uniform menace to life that is ordinarily supposed. It is unfortunate that facts are not at hand upon which a more accurate conclusion could be based, for, upon the determination of this point rests the justification or condemnation of radical intervention—particularly in the presence of acute inflammations; but both Chrobak and Schauta agree that, although life is rarely compromised by these diseases, they nevertheless expose the patient to the most serious complications. These complications vary somewhat in character according to the predominating element of infection. Thus, *gonococcous infection* presents a different picture from that depending upon the streptococcus.

The gonococcus, which, according to Reymond, is not found in the pus of an ovarian abscess, and which, according to all observers, is of less virulence and is shorter-lived in the peritoneal cavity than elsewhere, produces inflammation that is manifested with relatively greater virulence on the surface than in the parenchyma of the ovary. The result of such an infection is to produce an inflammatory exudate on the surface of the ovary and on the proximal peritoneal surfaces, resulting, in the majority of cases, in adhesions between the two. It also produces, first, thickening, and, subsequently, sclerosis of the investing tunic. As a result of these changes there occurs follicular degeneration. (See Morbid Histology of Ovaritis.) The clinical results of these changes are very distressing and very permanent. An ovary that is studded with unruptured and degenerated follicles, the pressure of which has resulted in the atrophy and practical disappearance of the stroma of the organ, is functionally useless. An ovary which is the seat of these changes frequently presents to the sense of touch a tension greater than that which exists in the eye. It can readily be understood that terminal nerve filaments in the ovary are subjected, under such circumstances, to an agonizing pressure. As a matter of fact, this condition is the most painful with which a woman can be afflicted. The exacerbations of pain incident to the premenstrual afflux of blood and to the futile efforts at ovulation, are agonizing in the extreme. Patients thus afflicted manifest every phase of the so-called reflex neuroses, and, not infrequently, are the victims of equally distressing psychoses. Hysteria, hystero-epilepsy, and their congeners, are sequelæ of frequent occurrence; while constipation, indigestion, self-intoxication and the anæmias, are frequent elements of the clinical picture. While this is true, it must be recognised that there are cases, relatively few, perhaps, in which there appears to be complete recovery of the organ. In *streptococcous infection*, however, the invasion takes place directly into the ovarian stroma, resulting in multiple coalescing abscesses and the consequent destruction of more or less of the ovary. As elsewhere pointed out, these purulent accumulations may become

very large and may find a spontaneous outlet through the intestines, the bladder, or the pelvic wall, or directly into the peritoneal cavity. Symptomatic recovery may follow any one of the three former, but death is the usual result of the last-named complication. Suppuration of the ovary involving a considerable destruction of the stroma, may be drained, either spontaneously, or by operative intervention, leaving a certain amount of ovarian tissue which, being yet studded with primordial cells, may subserve the function of ovulation. But, unfortunately, in at least the majority of these cases, suppuration of the stroma is associated with so much inflammation of a peripheral character that adhesions result, causing essentially the same painful and intractable conditions as have already been described as the results of gonococcous infection. When this occurs, there become established the essential underlying causes of chronic invalidism. It follows, therefore, that, viewed in the light of their natural terminations, even when these are the most favourable, infections of the uterus demand surgical intervention, generally of the most radical kind. It is to be hoped that the further revelations of experimental surgery may develop some means by which these organs may be either conserved, or replaced by structures with functional possibilities.

Palliative treatment of infections of the ovary must be considered with reference to (*a*) acute, and (*b*) chronic cases. In *acute inflammations* of these organs, particularly when the history of the case or bacteriological examination of it points to *infection by the gonococcus*, treatment should be based upon full recognition of the fact that these micro-organisms in the peritoneal cavity are of diminished virulence and of short life. The inflammation which they establish may be slight or severe, according to the susceptibilities and conduct of the patient. That there are some cases that react with greater intensity than others to inflammatory influences can not be denied; while exercise, particularly if violent, is calculated to augment an inflammatory process that has become established. The indications in these cases are for rest and elimination. The patient should be put to bed and should be given a saline cathartic. Opium should be avoided, and anodynes, if indicated, should consist of other agents of recognised value which do not arrest peristalsis. The hot vaginal douche, with glycerine tampons in the interval, should be employed systematically during the first four or five days. In mild cases the symptoms will disappear promptly after free catharsis induced by the salines; but patients should be kept in bed for several days after the subsidence of the pain. Ice-packs over the groin are generally of more value than applications of the opposite extreme of temperature, and should be applied from the start. In *streptococcous infection* the symptoms are generally more active, constitutional intoxication being more profound. If, in a given case, the symptoms do not indicate extreme virulence, the palliative measures already indicated may be relied upon; but where there exists manifest infection of the uterus, together with implication of the

pelvic lymphatics, palliative measures beyond those elsewhere discussed (see Streptococcous Infection of the Uterus) should not be relied upon. So soon as the enlargement of an ovary, with associated symptoms, indicates the presence of pus in that organ, surgical intervention is indicated.

Pneumococcous infection comes under the same rule. It should be stated here that surgical treatment should not be withheld while awaiting a precise diagnosis of the character of the infection, but should be adopted at once in the demonstrated presence of pus.

In *chronic cases*, the treatment is not addressed so much to the infection as to its consequences. As a matter of fact, in gonococcous infections, which comprise the majority of these cases, the micro-organisms are eliminated as active factors in the case during the acute stage. Under these circumstances, and in the absence of renewed infection, that which is generally recognised as recurrent inflammation is hyperæmia, induced mechanically by the action of adhesions or by the premenstrual wave, by the progressive accumulation of unruptured follicles, by engorgement of the portal circulation due to constipation, or by the traumatisms arising either from accident, or from sexual intercourse. Rest, laxatives, douches, and tampons, will generally relieve the distressing symptoms, the recurrence of which may, however, be counted upon in the renewed presence of the same exciting causes.

The **conservative treatment of infections of the ovaries** has for its object the perpetuation, so far as possible, of the functions of these organs. Whether in the presence of acute or chronic inflammation, treatment should be addressed to preservation of the organs, whenever this can be done consistently with the health and life of the patient. It would seem, as an abstract proposition, that an ovary the seat of parenchymatous suppuration, should no more be extirpated than a finger, the seat of a felon, should be amputated. Unfortunately for this hypothesis, however, the morphology of the ovary is such that an inflammation, once established in its parenchyma, generally results in its functional, if not its organic destruction. (See Morbid Histology of Ovaritis.) Cases have been reported in which an ovary, the seat of suppuration, has been brought down through a vaginal incision, punctured, the pus cavity packed with gauze, and the organ returned to the pelvis, with the result of complete recovery. The fact that an organ thus inflamed must remain inflamed for a time after operation, and that, during such persistence of inflammation, it is liable to develop adhesions, must stand as a barrier to the success of this treatment in any considerable number of cases. While the infection may be relieved, the consequences of the inflammation can hardly be averted. In chronic cases, in which the surgeon has to deal, not with the infection, but with its consequences, there seems to be a better prospect of restoring the organ. Reed has repeatedly excised a cyst or cysts of the ovary, stitched up the incision, and dropped the ovary back (Fig. 248). The results of these operations have not always been

satisfactory, and no guarantee can be given to the patient that she will be freed from pain. On the contrary, in a series of six such cases operated upon by Reed, all the patients applied for the radical removal of the organ before the expiration of three months. Schröder, according to A. Martin, was the first to attempt to remove only the diseased portion of an ovary, leaving the apparently healthy part. Martin adopted this method of practice in cases of adherent appendages in which the patency of the tube could be demonstrated, and concluded (Volkmann's *Sammlung klinischer Vorträge*) that the removal of the diseased portions of the ovary did not affect recovery from the operation; that excision of the closed or otherwise diseased portion of the tube did not affect the healing process; that women who had suffered such partial removal of the adnexa, were no more liable to an extension of the disease to the healthy portion of the resected organs than women whose ovaries were normal; and, finally, that in all these cases of excision, menstruation persisted and conception was possible. Several cases of pregnancy have been reported following the adoption of these conservative measures. If such measures are contemplated in a given case, they should only be practised with the knowledge and by the consent of the patient, who should be informed frankly of the liability of failure, and of the probable necessity of subjecting herself to a second and radical operation before she can be restored to health.

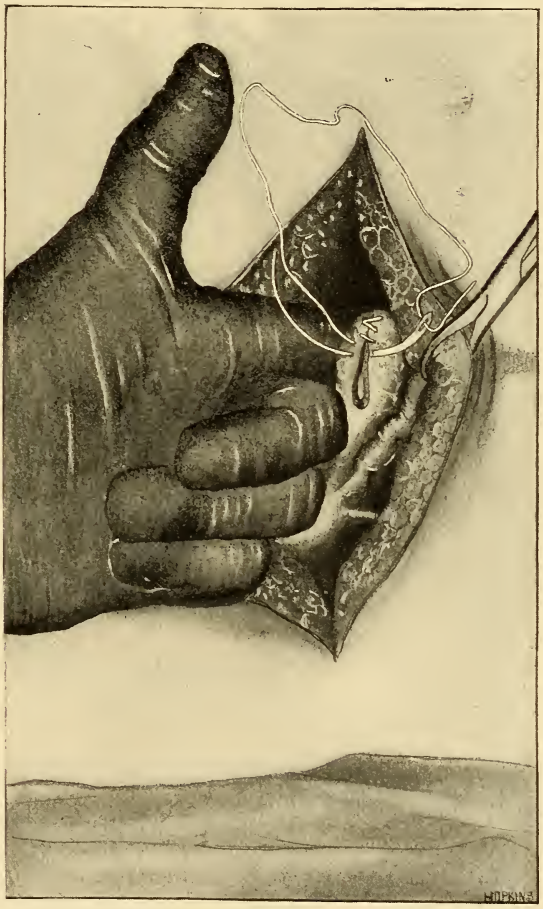

Fig. 248.—"Reed has repeatedly excised a cyst or cysts of the ovary, stitched up the incision, and dropped the ovary back."—Reed (page 582).

The **radical treatment of infections of the ovaries** consists in the removal of the diseased organs. As the Fallopian tubes without the ovaries are useless structures, and as they are generally diseased and can be removed under these circumstances without embarrassing the recovery of the patient, they too are generally removed.

Oöphorectomy is the name given to the operation for removal of the unenlarged ovaries; it is also known as Battey's operation, and as normal ovariotomy. It was first performed by Dr. Robert Battey, of Rome, Ga., on the 17th of August, 1872, for the purpose of causing the artificial and premature occurrence of the menopause in an otherwise incurable patient. The operation succeeded and the patient was restored to health. Battey, during the remainder of his life, operated frequently on this indication and with remarkable success. His purpose was to arrest the menstrual molimen, and to abolish thereby a painful and nervous class of symptoms which all other treatment in his hands had failed to cure. With this premature and forced change of life, came also a suspension, and finally an abolition, of the class of troublesome symptoms which culminated at the monthly period. In neurotic patients they frequently explode in violent hysterical attacks, while in aggravated cases insanity has sometimes resulted.

During the same year, February 11, 1872, Lawson Tait, in England, removed the ovaries and tubes for the cure of chronic inflammations and pus collections in the uterine appendages, and Hegar, in Germany (July 27, 1872), removed the ovaries to arrest the growth of small fibroid tumours of the uterus, and the hemorrhages caused by their presence. Tait's operation, upon what are now known as "pus tubes," is referred to in another part of this work. (See Infections of the Fallopian Tubes.)

Several of the conditions for which Battey operated are now relieved by less formidable treatment. The wave of sacrificial pelvic surgery seems to be passing, and a conservative tide, having for its object the saving of one ovary and part of the other if possible, is rising. (See Unilateral Removal of Ovaries.) The sudden and stormy onset of the change of life is thus prevented, and, while the diseased tissues have been resected, enucleated, or otherwise removed, the woman does not feel unsexed, as she calls it, and "so totally different from other women."

The operation was, for a time, overdone. Too many ovaries were removed by youthful inexperienced operators. The pendulum began gradually to swing the other way, till now, surgeons hesitate somewhat to perform oöphorectomy, even in the few cases where their best judgment dictates it to be the operation best suited to cure their patients.

The *indications* for oöphorectomy, as now practised, are chiefly infections of the ovaries; inflammations and their consequences; certain rare and otherwise incurable cases of dysmenorrhœa; certain otherwise incurable cases of ovarian pain, independent of the periods, and making the patient an incurable invalid; clear cases of menstrual epilepsy;

menstrual insanity, when the attacks occur only during the menstrual week, the patient being free from them during the interval; osteomalacia; and bleeding uterine fibromata, of small size, where the patient declines hysterectomy and other means fail. Recently, oöphorectomy has been proposed as a cure for mammary cancer, but authentic reports of favourable results are lacking upon which to found an indication.

The *technique* of the operation and the preparation of the patient, the surgeon, the nurses, and the operating room, do not differ materially from that of any median abdominal section until the abdomen is opened. (See Abdominal Section.) As there is no tumour, the incision need not be more than 2½ or 3 inches long. Two fingers, preferably of the left hand, are passed down to the top of the uterus and out along the tube and ovarian ligament to the ovary. Any adhesions are gently separated and the ovary, being grasped between the two fingers, is drawn up to and out of the abdominal opening. The tube should be well drawn up, also, and the pedicle transfixed as near the uterine cornu as possible, embracing the tube in its sweep. The loop of the ligature should be drawn through at least 6 inches and cut, thus making two ligatures, one being tied on one side, and one on the other, of the included tissues. Should any doubt exist as to the security of the constriction, one thread may be carried round the whole mass in the groove formed by previous ligatures, and the stump thereby doubly secured against any subsequent bleeding. A sufficient button of tissue should always be left where the ovary and tube are cut away, to prevent the ligature from slipping off during the vomiting and restlessness of the patient while recovering from the effects of the anæsthetic. The other ovary and tube are found in the same way as the first, brought to the surface, ligated, and cut off.

As in many cases the aim in oöphorectomy is to arrest menstruation with all that it implies, great care should be exercised in such cases to remove every vestige of both ovaries and tubes down to as near the uterus as possible. In order to remove the nerve supply which, it is asserted by Arthur W. Johnstone, of Cincinnati, and others, presides over the menstrual act, some surgeons remove a V-shaped piece of the uterine cornu and stitch together the sides of the cavity instead of applying the regulation ligatures to a pedicle.

There is rarely any loss of blood, and the peritoneal cavity not having been soiled in any way, no delay is necessary to complete a "toilet," and the abdominal incision is closed in the usual way. (See Abdominal Section.) The operation is frequently completed by an expert gynecological surgeon in fifteen minutes, and certainly should not consume more than half an hour by any one.

The **unilateral removal of the ovaries** or of the uterine appendages, leaving the other and apparently healthy appendages *in situ*, remains one of the moot questions of surgery, and one which presses itself for consideration in connection with conservative measures. The removal

of any organ not already the seat of disease, is against the instincts and impulses of surgery; and, yet, the frequency with which the remaining and apparently healthy ovary has become diseased in patients from whom the other and infected ovary has been removed, has raised the question as to the expediency of removing both organs at the first operation. In approaching a decision of this question, it is to be remembered again that the majority of all these infections are gonorrhœal in character; that an infection may travel up the uterus and out through the tube on one side, before passing up and out through the tube on the other side; and that a remaining ovary is, therefore, liable to inflammation caused by the later extension of the infection through the Fallopian tube of that side. On this point we may well accept the observations of Lawson Tait (*American Journal of Obstetrics*, 1887), as follows: "Actuated by the sound principle that no organ should be removed which is not diseased, in all the cases of the varieties of chronic, inflammatory, mischief in the uterine appendages, which have come under my care, I have not, in a single instance, removed the second set of appendages when they have been ascertained to be healthy. . . . I have been made painfully familiar with the frequency with which operations of this kind have proved absolutely useless for the purposes of the operation, and where the disease has recurred in the other side and demanded a second surgical interference. . . . But the opinion which I have formed . . . is that if a patient is suffering sufficiently to justify an abdominal section for chronic inflammatory disease of the uterine appendages, and only one side is found to be affected, the operation, to be of that lasting and complete benefit to the patient which we desire all our operations should have, must be made bilateral. On such a point as this, of course, the desire of the patient must be paramount as upon most others, and if a patient placed herself under my care for such an operation, and made it an imperative condition that I should not, under any circumstances, remove the second set of appendages if they were found healthy, I should yield to her decision; but I should argue the question with her, and advise her not to subject herself to the risks of a second operation, as seems to be by far the greater tendency in unilateral operations."

The **effects of removing the ovaries** must be considered with reference to their (*a*) primary and (*b*) secondary effects.

Primary effects take into consideration the mere question of surgical recovery—the healing of the wound, and the getting up of the patient. The question of mortality from the operation has established the safety of the procedure. Numerous operators have had long series of cases without a death. Tait once reported a series of 139 consecutive operations, the majority of them involving the removal of the ovary, without a death. The mortality from the operation should be studied with reference to (*a*) the character of the infection; (*b*) the constitutional state of the patient at the time of operation; (*c*) the

environment of the patient; and (*d*) the technique adopted. It may be stated without hesitancy that cases of streptococcous infection, whether operated upon early or late, yield the largest percentage of deaths. Recent acute infections in which the pus is yet virulent, are more dangerous subjects for operation than those in which the microorganism has reached its vital limitation. This latter remark, however, must not be accepted as a reason for permitting the pus of active and virulent infection to become innocuous before operation, for such delay without constant observation is fraught with extreme hazard to the patient—a hazard greater than that of operation. This leads naturally to a consideration of the constitutional state of the patient at the time of operation. Oöphorectomy done in the presence of an acute constitutional sepsis is always attended with a high mortality; and yet the majority of these cases can be said to have no prospect of recovery at all without operation. It is in these cases of acute virulent infection with more or less pronounced constitutional intoxication, that the conservative measure of tentative puncture and drainage should be practised. (See Vaginal Drainage.) The surroundings of the patient have much to do with her recovery. Nothing is more clearly demonstrated than the great advantage of a well-appointed and properly conducted hospital in the management of these cases; and it may be said with equal force that a poorly conducted and an improperly constructed hospital is more dangerous to the patient than any other possible surrounding. The mortality from abdominal section in cases of this class, may be conservatively placed at from 15 to 20 per cent when done either in poor hospitals or in no hospitals, and at less than 5 per cent when done in well-appointed and well-conducted institutions. The question of technique can not be discussed without taking into consideration the more personal element in the equation presented by the operator himself. It goes without saying that these operations, to be most highly successful, must be done with the greatest skill, and that skill can not be expected except as the result of training and experience on the part of the operator. The lives that are constantly sacrificed by untrained men who simply wish to try their hand at abdominal surgery, would fill a scarlet book of horrors.

The *secondary, or remote, results* should be considered with reference to (*a*) menstruation; (*b*) the sexual function, including reproduction; (*c*) the menopause; (*d*) the intrapelvic state; and (*e*) the general constitutional condition.

Menstruation is arrested in the majority of patients from whom both ovaries have been removed. Pfister studied 179 cases operated upon by Kuhne, between 1880 and 1896, and collected statistics from various other sources. He found, on a basis of 715 cases, that menstruation ceased in 87.5 per cent, the percentages of cessation in the various lists varying from 75.6 to 97.3 respectively. In a majority of cases there occurs a sort of post-operative metrostaxis, which may recur a few times after intervals of varying length, but this is not

to be looked upon as normal menstruation. A few patients menstruate during the first few months following complete extirpation of the ovaries and then cease. The reasons for the perpetuation of menstruation in the 12.5 per cent of Pfister's cases—and they are alluded to only because they may be accepted as an index of cases in general—are not given, and in the nature of things are not ascertainable. The fact, however, that in many cases of oöphorectomy it is necessary to leave a small segment of ovarian tissue *in situ* for the purpose of maintaining the ligature in position, and the fact that a similar segment is frequently left through carelessness in excising the ligatured appendages, will probably explain the majority of continuances of menstruation. It is known that in many cases in which more or less ovarian tissue is left designedly, the menstrual function persists. Bantock, Reed, and numerous other operators have reported cases of the long persistence of menstruation after both ovaries were known to have been completely removed. Gonzalez, of Diriamba, Nicaragua, reports (*New York Medical Journal*) an interesting case of persistent menstruation following, not only the complete removal of both ovaries, but of the uterus also.

The *sexual function* as influenced by oöphorectomy, should be discussed with reference to (*a*) genital sensation, and (*b*) reproduction. With reference to the *genital sensation*, including *libido sexualis*, it should be understood at the start, that neither is as uniformly existent among women as among men. Relative to this question Lawson Tait observed, that when it is "carefully inquired into, and without prejudice, it is found that women have their sexual appetites far less developed than men, a fact explained by the process, necessary in evolution, that the male has always been the struggling and aggressive creature. When the child-bearing period of a woman's life passes away, there goes with it a certain amount of her sexual appetite. In a few cases the appetite entirely disappears, but in an equally large number of instances it becomes exaggerated, sometimes grotesquely so. In the majority of women the appetite lessens, and even disappears, during the time of the climacteric disturbance, and then returns to its former condition, when the change has been effected." The sexual appetite in its relation to oöphorectomy, conforms to this law, and can not, therefore, be said to be unhealthfully modified. This theoretical view of the case seems to be supported by an investigation of the actual facts. Pfister reports upon 99 women, in 19 of whom the desire remained normal; in 24 it seemed somewhat diminished; in 35, in many of whom it had never been strongly developed, it was extinguished, while in 21 it had never been present. Women have conceived after the extirpation of both ovaries, and, for that matter, of both Fallopian tubes. Cases of this kind have been reported by Sippel (*British Medical Journal*), Sutton (*Transactions of the American Gynecological Society*) and Dunn (*Annals of Gynecology and Pediatry*). These cases are distinctly exceptional, and point to the fact that an ovule pre-

viously evolved may remain for a considerable time and retain its vitality in the folds of either the uterine ostium of the tube, or of the endometrium.

The *menopause* is generally precipitated with abruptness following the removal of the ovaries. The patients complain, from the very start, of hot flushes, and there is a constant sensation of temperature vacillating between heat and cold. The face burns, even without a corresponding turgescence of the cutaneous capillaries, although there do occur, to a certain extent, repeated changes from florid to pale. Associated with these phenomena are the more or less evanescent, but none the less distressing, nerve storms incident to the climacterium. (See The Menopause.) It can not be said that these phenomena differ in quality from those of the natural menopause, although they generally occur with more precipitation and greater violence. In some patients, however, they are but little noticed, and in all cases they disappear in from twelve to twenty-four months. It is the distressing character of these symptoms, in certain cases, that has prompted surgeons to attempt the mitigation of their severity by leaving in position a part or all of an ovary, even after the removal of the uterus and Fallopian tubes. Satisfactory reports have been offered by Bland Sutton and others, and it is probable that the practice will find increasing favour with operators.

The *general system* is influenced within certain limits by removal of the ovaries. In these cases, there occurs to a certain extent an exemplification of the law of antagonism between growth and genesis. When growth is active, the reproductive function is in abeyance; when, in turn, the reproductive function ceases, growth again attains its normal limit. This is shown in the increasing rotundity of figure following the normal menopause. The same tendency exists when the change of life is induced, artificially, by oöphorectomy. In Pfister's table, 52 per cent of the collected cases showed a tendency to increase in flesh; in 30 per cent the weight remained the same; while nothing is said about the remaining 18 per cent. With regard to those who increased in flesh, it is to be remembered that they were reduced by disease preceding the operation, and that, in many instances observable in the practice of all operators, the increase of flesh amounts to nothing but the resumption of the normal standard. Pfister by his investigations collected accurate data by which to refute many prevailing notions about the constitutional effects of oöphorectomy—notions the fallacy of which have been known to operators for decades. The vulgar idea that women who have lost their ovaries become gross and masculine, acquire bass voices and raise whiskers, is only an indication of popular ignorance which occasionally finds expression by an asinine physician. The effect of removal of the ovaries upon general metabolism has been a subject of inquiry, which has been given a fresh impetus by the investigations of Curatullo and Tarulli (*Annali di Ostetricia e Ginecologia*), investigations obviously undertaken for the

purpose of establishing the existence of what they designated an internal secretion of the ovary. In a series of observations on previously castrated lower animals, they observed variations in the elimination of metabolic products; while in osteomalacia they assumed to find a clinical confirmation of the theory that the ovaries secreted something which could not be found, but which, nevertheless, exercised an important influence over tissue change. They found, in brief, that ablation of the ovaries modified metabolism, increased phosphates in the urine, changed the nitrogen curve either up or down, diminished the elimination of carbonic acid and the absorption of oxygen, and increased the weight. In applying their doctrine to women they failed, however, to take into account that every fact which they had noted was consistent with a return to the normal equilibrium of nutrition. They mentioned that the injection of ovarian juice caused an increased elimination of phosphates, proportionate to the amount injected, but they failed to take into account the fact, that a similar elimination of phosphates occurred following the similar injection of like foreign elements into the circulation. They assumed that this element, whatever it was, favoured the oxidation of phosphates, and they called attention to the point that, after removal of the ovaries, or before or after puberty, there should be an increase of calcareous salts in the bones, the deposition of the latter being determined by the action of the ovarian juice. It is unfortunate for this theory that, in the natural course of events, ovarian quiescence before puberty is associated with a minimum, while ovarian quiescence after the menopause is associated with a maximum, of lime salts in the bones. If the position of these investigators were tenable, it would follow that the condition of the bones before puberty and after the menopause would be the same. Relating to this subject, it is interesting to note that Heyse (*Archiv für Gynäkologie*), from a careful microscopic study of ovaries removed from osteomalacic subjects, decides that there is no reason to infer that there is any diminution in the number of primordial cells under these circumstances, and consequently that there is no ground upon which to predicate a variation in the so-called "internal secretion."

Intrapelvic morbid conditions are always modified, if not always cured, by the ablation of the appendages. The restoration of otherwise hopeless invalids to symptomatic health, is the crowning triumph of this operation in the great majority of cases. Many women after passing through this operation, and through the neurotic disturbances of the artificial menopause, are freed from pelvic pain and are otherwise healthy. There are cases, however, and a number of them, in which the removal of the ovaries, whether for acute infection, chronic inflammation, or cystic degeneration, is not followed by complete cure, or even pronounced amelioration, of the pre-existing intrapelvic pain. In some of these cases the painful symptoms subside only after the lapse of one or two years. The reason for this delay in

recovery, or failure to recover at all, as the case may be, is to be found in the inflammatory changes which have become established outside the adnexa. Subserous exudates causing pressure on filaments of the sacral plexus, and organized inflammatory products in the parenchyma of the uterus causing pressure on terminal nerve twigs in that organ, are, for the most part, accountable for this persistence of pain. Inflammatory changes of a more or less permanent character in the nerve sheaths themselves are to be taken into account in this connection. A well-established uterine sclerosis of inflammatory origin is a perpetually painful condition. It is for this reason that the French school inaugurated the practice of removing the uterus with the adnexa for the relief of otherwise incurable infectious inflammations. (See Doyen's Operation and Panhysterectomy under Treatment of Infections of the Fallopian Tubes.)

CHAPTER XXXIX

TROPHIC DISEASES OF THE OVARIES

Atrophy—Cirrhosis—Hypertrophy.

Atrophy of the Ovaries.—Atrophy of the ovaries, a physiologic change at the climacteric, becomes pathologic when it occurs in women during the period of sexual activity. This variety is to be carefully distinguished from so-called cirrhosis, the result of disease. Moreover, it should not be confounded with nondevelopment of the gland in women who have never menstruated.

Causes.—In a well-recognised class of cases, Coe observes that the rapid development of obesity in young women is associated with scanty menstruation, which may eventually cease entirely. Since the uterus is normal in these subjects, there is little doubt that the ovarian function ceases in consequence of follicular atrophy, though opportunities for studying this condition anatomically are rare. Coe has had a chance to verify his opinion at the operating table in a typical case. The intimate relation between the ovarian activity and the nutritive processes is illustrated by the fact that, on reducing their weight, such patients may again menstruate with a fair degree of regularity, the flow again disappearing as they return to their former state of obesity. Premature atrophy has resulted from alcoholism, syphilis, the acute exanthemata, rheumatism, and typhoid fever, though in the febrile diseases there is probably a previous inflammatory process in the ovary. Prolonged pressure upon an ovary, in connection with uterine fibroids and broad ligament cysts or disturbance of its vascular supply by dense adhesions and exudates, may lead to complete glandular atrophy in young subjects. So-called cirrhosis is often erroneously described as an inflammatory process. Fibrous degeneration would be a more accurate term. While it may represent the termination of a previous acute inflammation, it is usually a form of chronic hyperplasia in which the follicles are entirely destroyed and the ovary is transformed into a mass of firm connective tissue. Such ovaries are often associated with chronic salpingitis and pelvic exudates, leading to the inference that obstruction to the blood supply is mainly responsible for this form of atrophy. Atrophic changes may follow supravaginal amputation of the uterus when one or both ovaries have been left *in situ*.

Pathology.—An atrophied ovary differs in its microscopic appearance from the organ after the normal climacteric, not so much in size, as in its irregular, nodular shape, and dense, almost cartilaginous, consistence. The cortex is much thickened, often from accompanying perioöphoritis. On section, the surface presents a uniformly firm, fibrous structure, with few or no traces of follicles. When these are present, they are either atrophied, or, rarely, dropsical, their walls being greatly thickened. The arteries are few and their lumina contracted, and there are no evidences of leucocytic foci.

Symptoms.—There are no symptoms characteristic of atrophy, if we except amenorrhœa and sterility in cases in which both ovaries are affected and sexual appetite is in consequence diminished or absent. Previously to complete atrophy, menstruation is irregular and painful, especially when the glands are buried in adhesions. In fact, the symptoms are due rather to the accompanying condition.

Prognosis.—Great circumspection is necessary in giving a prognosis in these cases, or in promising certain definite results from treatment. It is idle to expect an anatomical cure or restoration of function in an ovary in which the normal stroma and follicles have completely disappeared. In the case of the young obese subjects before alluded to, in whom the uterus is still of normal size, rigid diet and exercise, baths, electricity, and massage (and especially a course at a foreign spa, such as Marienbad) may stimulate the ovaries to renewed functional activity. The possibility of conception is doubtful, so that it is not right to encourage the patient with false hopes.

Treatment.—When the atrophied organs are adherent and give rise to constant pain and dysmenorrhœa, little is to be expected except from operative intervention. In the case of young women who desire to preserve their ovaries it may be sufficient to separate adhesions, in fact, the writer once saw menstruation return and persist after this simple procedure; but when the flow has ceased entirely and the glands are transformed into mere fibrous nodules, there is no object in retaining them.

Cirrhosis of the ovaries requires at least brief consideration. It has been, and is still, the custom to regard the condition of the ovaries known as cirrhosis, as a mere sequence of an acute oöphoritis. But there is ample evidence that this condition may occur independently of inflammation. It is found fully developed without antecedent history of infection in women under thirty years of age, and it may involve one or both ovaries. It gives rise to severe pain in the affected ovary, especially before menstruation. Its persistence may lead to neurasthenia or to some other form of neurosis. The ovary in these cases may or may not be prolapsed, is firm, unyielding, globular in form, sensitive to the touch, but usually not adherent. In the earlier stages of the disease, the ovary presents a relatively normal appearance, but as the morbid process progresses, as it usually does, the organ contracts at the expense of the vascular stroma or medullary

substance until all true gland tissue has been destroyed. As a result of the fibrous contractions the surface of the ovary is made to resemble, in miniature, the convolutions of the brain. It will follow as a natural conclusion that the majority of women suffering from cirrhotic ovaries, are sterile.

The symptoms are not always constant. So true is this, that the patient can seldom state definitely when they began. The pain has been described as of a sharp, darting, sickening or throbbing character, in one or both ovarian regions, but more frequent and severe in character in the left ovary. This pain has its greatest intensity from a few days to two weeks prior to the menstrual period, and is usually accompanied with nervous reflexes, such as hysterical manifestations, backache, etc. In many of the cases, owing to the intimate nerve connection with the lumbar ganglia of the spinal nerves, pain will be referred to the front and inner side of the thigh and to the hip joint. Dyspareunia is absent in many cases, owing to the fact that the ovaries are small and are not prolapsed and tender.

In the early stage of these cases they may be treated, with some relief of the pain, by electricity, but the results from this agent have not been at all satisfactory. All cirrhotic ovaries do not require removal. It is in cases where other means have failed, and where the woman has been rendered an invalid or her suffering has become almost intolerable, that the removal becomes imperative.

Hypertrophy of the Ovaries.—This may be defined as an enlargement of the ovary, the result of former inflammation or chronic congestion. It is cystic or fibrous, according as the change affects the follicles or stroma, though the two conditions are commonly associated.

Causes.—So-called chronic oöphoritis leading to hypertrophy, according to Coe, is doubtless the termination of an acute inflammatory process, which does not terminate in abscess formation, hence it may be due to puerperal or gonorrhœal infection associated with similar disease in the tube. But the most common cause is long-standing pelvic congestion, such as accompanies tubal disease, peritonitis, and uterine and ovarian tumours. A prolapsed ovary, especially when surrounded by exudate, is liable to undergo hypertrophy. Chronic constipation also is an exciting cause, which fact may account for the relatively greater frequency of hypertrophic changes in the left ovary, which is not only in close proximity to the sigmoid flexure but has a valveless vein. Primary hypertrophy is sometimes traceable to sexual excess, traumatism, or frequent pregnancy and abortion. Cystic degeneration may result from disease of the individual follicles which are prevented from reaching the surface of the ovary or, when situated in the peripheral zone, can not rupture in consequence of pathologic thickening of their walls or peri-oöphoritic adhesions or exudates.

Pathology.—The follicles become dropsical and few or many cysts develop. A hypertrophied ovary may be enlarged to several times

its normal size, and presents an irregular shape, with one or more cysts of variable size, sometimes as large as English walnuts, projecting above its surface; on palpation, there is a more or less distinct sense of fluctuation. Or, if the fibrous element predominates, the ovary may be globular or oval in shape, with a smooth whitish appearance and firm consistence. Fibroid ovaries are usually prolapsed, from their increased weight, and are often freely movable, though if there is accompanying tubal disease they are apt to be buried in exudate. On section, such an ovary shows marked thickening of the cortex, with general induration of the stroma due to proliferation of the fibrous tissue. A few small cysts with thickened walls are seen, or no traces of the follicles remain. The walls of the arteries are usually thickened, the lumina are dilated and hyaline degeneration is common. In cystic hypertrophy the walls of the dropsical follicles are thickened and they contain a clear fluid, normal, or, not infrequently, a single cyst may encroach upon the stroma to such an extent that only a narrow zone remains.

Symptoms and Diagnosis.—The symptoms are often due principally to coexisting conditions—adhesions, tubal disease, or neoplasms. In uncomplicated cases, the patient complains of severe pain in one or both groins or in the sacrum, which is increased a day or two before the menstrual flow, sometimes recurring in a paroxysmal form during the intermenstrual period. The pain may radiate down the thighs and is often accompanied by reflex neuralgiæ of the intercostal nerves and pelvic organs. If the ovary is prolapsed in Douglas's pouch, a peculiar sickening pain is felt during defecation and coitus. Locomotion is often attended with severe pain in the groins and sacrum, extending down the lower limbs; if the ovary is fixed by adhesions these symptoms are aggravated. Menstruation is apt to be irregular. Menorrhagia is common in connection with cystic hypertrophy. Sterility results from the general disappearance of the normal gland tissue, though conception is always possible so long as healthy follicles persist. The effect of the local disturbances upon the general health may be such that the patient becomes a nervous invalid. The various hystero-neuroses are frequently referable to the ovarian condition.

Treatment.—The treatment is palliative or surgical according to the extent of the disease and the severity of the symptoms. Sexual intercourse must be controlled, and rest during menstruation insisted upon. Hot vaginal douches and regulation of the bowels are routine measures in every case. Ichthyol tampons often accomplish unexpected results, especially in the case of tender ovaries which are adherent in the cul-de-sac. Local galvanism and the fine wire secondary faradic current often relieve pain to a marked degree. Pelvic massage is useful in the absence of subacute inflammation, or accompanying pyosalpinx or hematosalpinx. The bromides are indicated to allay nervous manifestations. To relieve dysmenorrhœa, the coal-tar

derivatives, viburnum compound, and apiol are useful. Opium should be used with caution, preferably in the form of codeine. Postural treatment during menstruation (raising the hips, or even the Trendelenburg position) sensibly diminishes the throbbing pain due to excessive pelvic congestion. Before resorting to operative procedures, nonsurgical treatment should receive a fair trial, and an examination should be made under anæsthesia in order to determine the extent of the disease.

An ovary adherent in Douglas's pouch may be readily reached by vaginal section (preferably through the posterior fornix), freed from its adhesions, and examined with a view to the necessity of removal. The abdominal route doubtless enables the operator to study the conditions more intelligently and to separate thoroughly all adhesions. Conservative surgery should be practised whenever this is possible, especially in cases of cystic hypertrophy. An ovary which is merely prolapsed and is not generally diseased may be simply sutured in its normal position. There is no object in trying to save one which is the seat of general fibroid hypertrophy, with no trace of normal follicles.

When both ovaries are similarly diseased and the tubes are also generally affected, it is better to remove the adnexa on both sides, especially if the woman has long been sterile. But her wishes must, of course, have considerable weight. No fixed rule can be formulated to fit every case, as the surgeon must decide for himself regarding the extent of the disease and whether the best interests of the patient will be served by a conservative or a radical operation.

CHAPTER XL

NEOPLASMS OF THE OVARIES

Benign neoplasms: Small benign cysts; simple or follicular cysts, cysts of the corpus luteum, tubo-ovarian cysts: Neoplastic cysts; proliferating cysts and their varieties; dermoid cysts and their varieties: Solid tumours; fibroma, calcified tumours—Hematoma — Malignant neoplasms: Primary carcinoma; medullary carcinoma; adenocarcinoma; secondary carcinoma: Sarcoma: Endothelioma.

Neoplasms of the ovaries are of frequent occurrence, and of several varieties. There is probably no organ in the body that is so susceptible to neoplastic changes. These will be considered in the following order:

Benign Neoplasms:

1. **Small benign cysts:** (*a*) follicular cysts, (*b*) cysts of the corpus luteum, (*c*) tubo-ovarian cysts.
2. **Neoplastic cysts:** (*a*) proliferating cysts (pseudomucinous and serous), (*b*) dermoid cysts.
3. **Solid Tumours:** (*a*) fibroid tumours, (b) calcified tumours.
4. **Hematoma.**

Malignant Neoplasms:

1. **Carcinoma:** (*a*) primary, (*b*) secondary.
2. **Sarcoma.**
3. **Endothelioma.**

Benign Neoplasms

Small Benign Cysts of the Ovary.—The ovary by reason of its peculiar anatomic structure is greatly predisposed to cyst formation, and perhaps this tendency is shared by no other organ of the body to the same extent.

The smaller cyst formations have been variously named, as hydrops folliculi, hypertrophy of the follicle (Ziegler), small cystic degeneration (Hegar), and follicular cysts.

Slightly dilated follicles and small follicular cysts are distinguished by no essential difference in appearance; so that the clinician is often perplexed to determine what constitutes the degree of cyst formation to be designated pathologic.

Between the somewhat dilated follicles so frequently met with as an accompaniment of chronic oöphoritis, and true cysts, no sharp dividing line can be drawn, so that frequently a careful histological study is necessary before each can be placed in its proper class. Martin (*Krankheiten der Eierstöcke,* S. 324) has proposed to regard as hydrops folliculi those dilated follicles which reach a size whose diameter is not greater than the thickness of the normal ovary, and to designate as true cysts only those reaching a greater size. Winter (*Gynäkologische Diagnostik*, page 174), on the other hand, reserves the term cystic, to be applied to those ovaries which reach the size of a hen's egg.

Pathologic cyst formation of the ovary is primarily divided into two groups:

1. Simple or follicular cysts.
2. Neoplastic cysts.

To the first group belong (*a*) follicular cysts; (*b*) cysts of the corpus luteum; (*c*) tubo-ovarian cysts; while under the second group are usually classed (*a*) proliferating cysts; (*b*) dermoid cysts.

Simple or Follicular Cysts.—Various theories have been advanced in explanation of the development of follicular cysts, but in the majority of instances they are probably due to previous inflammatory changes in the ovary, the fibrous tunic of which has become thickened, thus preventing the rupture of the follicle, and are therefore retention cysts. According to Olshausen, they frequently develop in the following manner: In the beginning, the ovary will contain several dilated follicles (Fig. 249), which materially increase its size; sooner or later, one of the follicles takes on abnormal growth and expands on the surface of the ovary in the direction of least resistance. Pressure from the increasing contents produces atrophy of its wall which becomes thin. When the cyst reaches some size (Fig. 250), it replaces the ovary, which has now become flattened from pressure, and appears as a mere thickening of the basal wall of the cyst, while the peripheral wall of the cyst is thin. As a rule, they develop on the surface of the ovary, the walls of which are thick and consist largely of ovarian tissue. Follicular cysts may be freely movable and even pedunculated or they may develop within the ligament.

Fig. 249 (Whitacre).—"In the beginning, the ovary will contain several dilated follicles."—Rothrock.

They vary in size from that of a pigeon's egg to that of an orange, though, exceptionally, much larger cysts have been met with, reaching the size of an adult's head.

The wall of the cyst varies in thickness, and the external surface may be smooth and shining, or rough from adhesions. The inner surface of the cyst wall is as a rule smooth, shining, and fascialike,

though occasionally a few small wartlike, papillary growths, are observed springing from the surface.

Follicular cysts are usually unilocular, though sometimes two or more cysts may fuse, in which case the remains of partitions or trabeculalike formations may be seen.

In the early stages of development so soon as the follicle begins to dilate, the ovum dies and the membrana granulosa undergoes fatty degeneration and disappears.

The cyst contents, which represent the epithelial secretion with perhaps some transudation from the blood vessels, consist of a thin clear straw-coloured fluid with a specific gravity of from 1.005 to 1.026, and may at times be blood-tinged or turbid. As a rule, the sediment is small, and contains a few formed elements consisting chiefly of degenerated epithelial cells, fat drops, and at times a few blood corpuscles and cholesterin crystals.

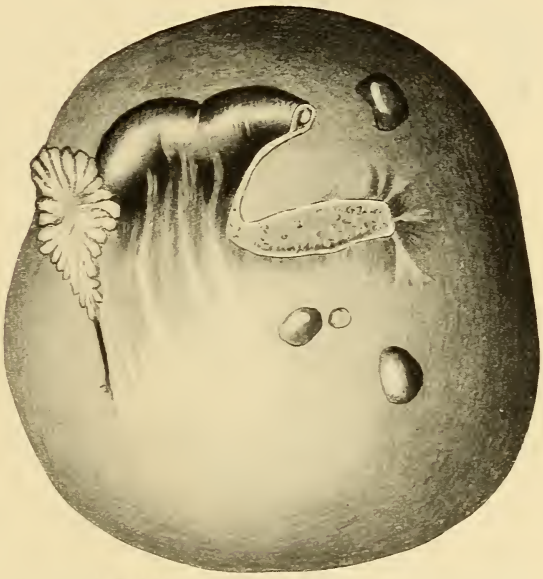

Fig. 250 (Pfannenstiel).—"When the cyst reaches some size it replaces the ovary."—Rothrock (page 598).

Histologically, the wall of the cyst is composed of connective tissue with occasionally some ovarian stroma. The internal surface is lined with low cylindrical or cuboidal cells, or it may be without epithelial lining.

Cysts of the Corpus Luteum.—The observations of Nagel, Bulius and Fränkel, prove beyond doubt that cysts may develop in the ruptured as well as in the unruptured follicle. To Rokitansky, however, belongs the credit of being the first to describe cysts of the corpus luteum. Like follicular cysts, they are of slow growth and rarely reach large size, usually not larger than a walnut, though in a few instances they have been observed as large as a fœtal head, and, rarely, as large as a man's head. They are usually solitary, but two have been observed in the same ovary.

In the beginning, they are usually situated in one or the other pole of the ovary (Fig. 251), but as they increase in size they gradually replace the ovary, which appears as a flattened mass on the cyst wall. Like follicular cysts, they are unilocular, but differ very materially in

having thick walls made up of two layers, which may be easily separated from each other. The inner stratum, which is called the lutein layer, is arranged in folds, and is further characterized by being of a yellow orange or brown colour. The outer layer represents the tunica fibrosa of the normal corpus luteum.

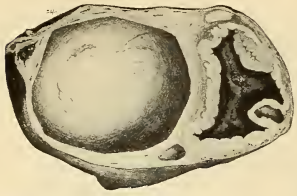

Fig. 251 (Whitacre).—"Cysts of the corpus luteum . . . are usually situated in one or the other pole of the ovary."—Rothrock (page 599).

The cyst contents consist, in most instances, of a clear serous fluid, which is probably the product of transudation from the very vascular lutein layer of the cyst. Microscopically, they differ widely in appearance. In some cysts, the inner stratum is of typical corpus-luteum structure, consisting of large epithelioid cells lying thickly in a scant network of fibrillary connective tissue very rich in capillaries. In a few instances, the innermost layer has been found to consist wholly of connective tissue (L. Fränkel, *Archiv für Gynäkologie*, Bd. lvi, H. 2).

The recent observations of Orthmann and L. Fränkel leave no doubt that occasionally cysts of the corpus luteum may be lined by epithelium. The character of the epithelium is usually cylindrical, but may be cuboidal or approach the squamous type. The cells are not always regularly arranged, but may be here and there set diagonally to the surface.

The *etiology* of these cysts is not known. The frequent coexistence, however, of chronic oöphoritis suggests that the chronic hyperæmia incident thereto, may have been the determining cause of the increased transudation which gave rise to cyst formation.

Blood cysts constitute another variety of cysts of the corpus luteum, which are not so uncommonly met with, and are of much pathological interest and clinical significance.

Attention has been called to these cysts by certain French writers, as Robin, Rollin, Doléris, Petit, and especially Pilliet.

More recently, Orthmann (*Verhandlungen der deutschen Gesellschaft für Gynäkologie*, 1897) has made a careful and exhaustive study of these cysts, and concludes that they originate from hemorrhage into the corpus luteum.

According to Orthmann, these cysts are usually superficial, and are most frequently found at one or other pole of the ovary. They are round or oval in shape, and vary in size from that of a walnut to that of the head of a newborn child. They are frequently firmly adherent to the surrounding structures and may be bilateral.

According to Orthmann, it is not always possible to distinguish between these blood cysts and primary cysts of the broad ligament into which hemorrhage has taken place, and they may be confused with ovarian pregnancy.

The cyst contents vary. In small cysts, the blood may be coagulated, while, in the larger ones, it is usually liquid and of a reddish, dark brown, or chocolate colour. On section, one finds the cyst wall composed of the characteristic structure of corpus-luteum cysts (Fig. 252).

In small as well as in large cysts, the inner wall is uneven and more or less strongly folded, and is of a yellow or brown colour.

The microscopic appearance of the wall of the cyst is, in many cases, similar to that of corpus-luteum cysts already described; while, in others, there are present many of the histological changes occurring in the various stages in the process of regeneration of the normal corpus luteum. Like corpus-luteum cysts, they may sometimes be lined with epithelium.

Fig. 252 (Whitacre).—"On section, one finds the cyst wall composed of the characteristic structure of corpus-luteum cysts."—Rothrock.

Tubo-ovarian Cysts. — Cysts are occasionally encountered which involve both the ovary and the Fallopian tube. Various theories have been advanced in explanation of such cyst formation, but from the great variety which have been described, it is evident that no one theory will explain all cases. It is probable, however, that pelviperitonitis with resulting adhesion of the pavilion of the tube to the ovary, is primarily an important factor in their formation. The exhaustive studies of Rosthorn have done much to elucidate this subject. He concludes that tubo-ovarian cysts may develop from any one of the following conditions, which he divides into two groups: The *first* group includes:

(*a*) Cases in which a pyosalpinx becomes adherent to the wall of a coexistent abscess of the ovary, with subsequent perforation of the wall separating them.

(*b*) Adhesion of the pavilion of the tube to the wall of a suppurating ovarian cyst, with subsequent development of a hydrosalpinx and perforation of the cyst into the tube.

(*c*) Adhesions of a hydrosalpinx to a papillomatous cyst, with subsequent perforation of the intervening wall by papillary growths.

To the *second* group belong:

(*a*) Cases in which a hydrosalpinx becomes adherent to the wall of a follicular cyst, with subsequent perforation of the septum.

(*b*) Cases in which the fimbriæ of a previously diseased tube become caught in the opening of a ruptured follicle at the moment of rupture, and become adherent to the wall of the follicle with the development of a tubo-corpus-luteum cyst.

While undoubted instances of each of these modes of origin have been observed, the classical tubo-ovarian cyst is of follicular origin, and only rarely are proliferating cysts communicating with a dilated Fallopian tube encountered.

These cysts are usually unilateral, though they may be bilateral, and they vary in size from that of a pigeon's egg to that of a closed fist, and, exceptionally, larger ones have been observed. The junction of the tubal portion of the cyst with the cyst proper, is marked by a sharp flexion, giving it the peculiar and characteristic appearance of a retort (Fig. 213, p. 498).

As a rule, the larger portion of the cyst is developed from the ovary, and is round or oval. The cyst wall is usually smooth, if not adherent, and in large cysts may be quite thin. In most instances, it is more or less adherent to the surrounding structures.

Tubo-ovarian cysts are unilocular, and not infrequently they communicate with the uterine cavity, through which the contents are periodically emptied. The opening between the ovarian and tubal portions of the cyst varies in size, and is frequently guarded by a valvelike formation, the remains of the septum (Fig. 253).

Fig. 253 (Martin).—"The opening between the ovarian and tubal portions of the cyst . . . is frequently guarded by a valvelike formation."—Rothrock.

The cyst contents consist usually of a clear serous fluid similar to that of follicular cysts. They may, however, be turbid, blood-tinged, or chocolate-colour from disorganized blood.

Histologically, the wall of the cyst is composed of connective tissue, while, in the tubal portion, atrophied muscle fibres may be observed. The epithelial lining of the ovarian portion of the cyst consists of low cylindrical, cuboidal, or spindle-shaped cells, or may be without epithelial lining, while the tubal portion of the cyst is lined with cylindrical epithelium which is frequently ciliated.

Neoplastic Cysts.—*Proliferating cysts* constitute by far the greater proportion of tumours of the ovary. They have been variously designated as simple, compound, areolar, unilocular and multilocular, colloid and myxomatous cysts, all of which are clinical distinctions depending upon their most striking features. Waldeyer divided proliferating cysts into two groups: Proliferating glandular, and proliferating papillary cysts, according as they contained papillary growths, or not; and this division has been generally followed by most writers

to the present time. It will be observed that this is a purely clinical, and rather vague and indefinite, ground for division, based entirely upon macroscopic appearance and admitting of no very sharp distinction, since many cysts come under observation in which the characteristic features of both are present to an almost equal degree. The most satisfactory division yet made, and one founded on a chemical and anatomical basis, and at the same time admitting of marked clinical distinctions, is that recently proposed by Pfannenstiel. Leaving out of consideration mere clinical appearance, Pfannenstiel sought to distinguish ovarian cysts by the chemical constituents of their contents, and found that a large proportion of cysts contained a chemical substance long known and formerly called paralbumin and metalbumin. Hammarsten, however, found that it was not an albumin, but a substance resembling mucin, which he termed pseudomucin. In a smaller, and at the same time clinically sharply differentiated class of cysts, Pfannenstiel found that this substance was not present in the contents. Carrying his investigation further, he discovered that they differed histologically in the character of their epithelial lining. In the first group, the cells were cylindrical and resembled mucous cells, while in the second group, the cysts were lined by ciliated columnar epithelium. He further observed that the two groups differed greatly in the gross appearance of their contents. Those of the first group were more or less thick, turbid, and often colloid, in appearance, while in the other, they were thin, clear, and serous. He therefore divided all proliferating cysts into—

(1) Pseudomucinous cysts.

(2) Serous cysts.

Pseudomucinous (*Proliferating*) *Cysts.*—To this group belong the greater proportion of ovarian cysts. They are usually unilateral, and they vary in size from a mere beginning cyst only sufficiently large to be recognised, to tumours of enormous dimensions, often filling the abdominal cavity, displacing other viscera, and encroaching seriously on the thoracic cavity.

Cartledge has reported (*Journal of the American Medical Association*, 1897) the largest cyst of the ovary on record. The tumour had been growing for thirteen years, and for the last four years very rapidly, so that the patient had been unable to assume a reclining posture for more than a year and a half. The circumference at the umbilicus was 79 inches. The woman was 5 feet 4 inches in height and well formed, except that she was very much emaciated from carrying this enormous cyst. Twenty-four gallons of ovarian fluid were removed before she was placed in position to be anæsthetized. After that, she was placed on her back and 10 additional gallons of fluid withdrawn. The adhesions to the anterior parietal wall were terrific. Many ligatures were used, and the operation consumed about two hours under unfavourable circumstances. The woman survived the operation fairly well, leaving the table with a pulse of 114. On the fifth day she had a

normal temperature and a pulse of 108. Beginning with the sixth day, symptoms of intestinal obstruction developed and she finally died. The fluid withdrawn weighed 240 pounds and the sac 5 pounds.

Other very large tumours have been reported, one successfully removed by Gilliam, of Columbus, weighing 176 pounds. A. H. Cordier has reported a cyst which weighed 160 pounds (Fig. 254). Tumours of 100 pounds are occasionally encountered.

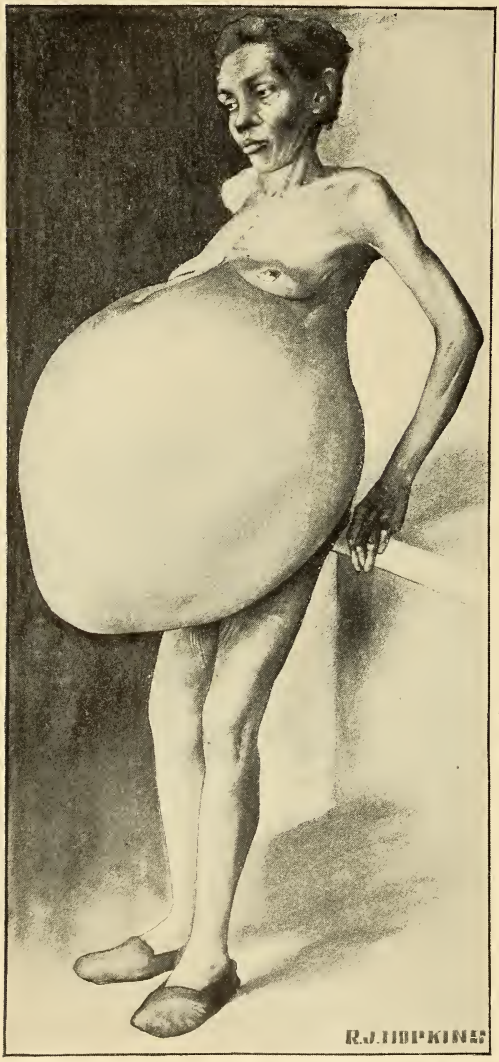

Fig. 254.—"A. H. Cordier has reported a cyst which weighed 160 pounds."—Rothrock.

It is no longer common, however, to meet with such large cysts, inasmuch as surgical aid is usually sought before the tumour reaches a great size. They may occur at any period of life, from puberty to advanced age, although they are most frequently encountered during the childbearing period, especially from thirty to forty-five. Unmarried and sterile women seem to be especially predisposed. Whether, as has been suggested, pregnancy and lactation by temporarily interrupting the menstrual function afford a protection against tumour formation we do not know. It is conceivable, however, that the periodical congestion incident to menstruation, may have a determining influence.

The shape of the tumour is usually spherical, ovoid, or irregular in outline. If small, it is usually irregular in shape from partial fusion of two or more cysts presenting no uniformity of structure. Larger tumours, while generally assuming a spherical shape, are often uneven in outline, with here and

there nodular prominences due to bulging caused by smaller cysts developing in the cyst wall.

The external appearance of the tumour is pearly white or bluish, often smooth and glistening, and at times it has a cartilaginous appearance. Over the surface, blood vessels of varying size are frequently seen ramifying. Occasionally, bands of unstriped muscle fibre and the remains of ovarian stroma are to be seen spread out over the tumour, especially near the pedicle.

On section, the tumour will be found to consist of a conglomeration of a greater or less number of cysts (Fig. 255). Usually, one cyst attains a considerable size and constitutes the main portion of the tumour, while, in its wall, are developed numerous smaller cysts which encroach on the lumen of the main cyst. Sometimes, the entire number may be composed of a conglomeration of innumerable small cysts, separated from each other by a more or less dense structure giving it on section a honeycombed appearance. Usually, the individual cysts are separated from each other by walls of varying thickness composed of highly vascularized connective tissue. These septa frequently become very thin from pressure atrophy, and may rupture, resulting in fusion of several cysts with intermingling of their contents. Frequently, the remains of such septa may be seen in the main cyst forming trabeculalike processes on its internal surface. Gradually, these septa disappear from pressure, and in old or very large cysts, the entire tumour may consist of one large space, though usually smaller flattened cystic spaces will be found in its walls. The internal surface of the cyst is usually smooth, though it may be covered here and there with wartlike excrescences, dendritic, or cauliflower growths. These may be few or quite abundant. As a rule, the larger the cyst, the smoother will be its wall, and the fewer papillary growths it will contain. These papillary growths differ much in appearance. They are usually of a gray colour, but may be pink or dark red if rich in blood vessels.

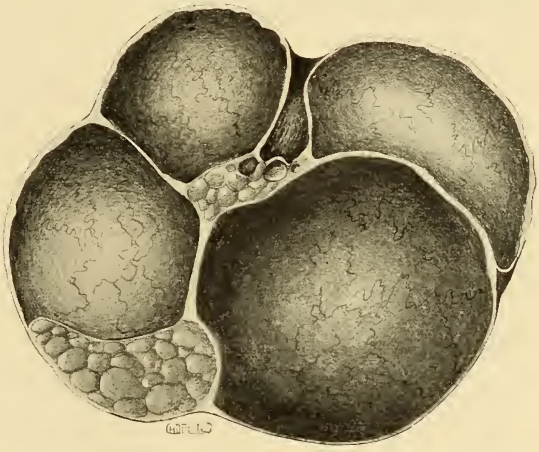

Fig. 255 (Martin's Handbook).—"On section, the tumour will be found to consist of a conglomeration of a greater or less number of cysts."—Rothrock.

The cyst contents are the product of cell secretion from the lining membrane. The contents of the individual cysts composing the

tumour may present the greatest diversity of appearance and consistence; one obtained by Pfannenstiel contained a bright transparent body, probably a degenerated ovum (Fig. 256). In general, they consist of a fluid with a specific gravity of from 1.010 to 1.030, of the consistence of honey, though at times it may be thick, ropy, and gelatinous, especially in the smaller cysts.

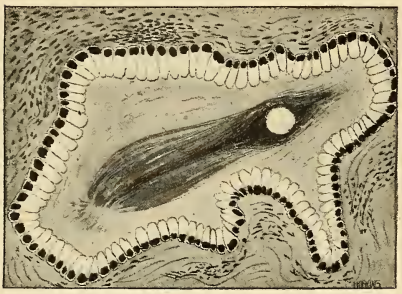

Fig. 256 (Veit's Handbook).—"One obtained by Pfannenstiel contained a bright transparent body, probably a degenerated ovum."—Rothrock.

In colour it varies quite as much as in consistence. It is usually turbid, and often has the appearance of oily water; it may be gray, yellowish, greenish, or wine-colour, and sometimes it is dark brown from admixture of blood.

Microscopically, it is usually poor in organized elements, being composed chiefly of a homogeneous mass which may contain a few fat globules, degenerated epithelial cells, and, at times, a few red blood corpuscles, hematin and cholesterin crystals.

The cell described by Drysdale and considered by him a pathognomonic diagnostic sign of ovarian cysts is no longer so regarded.

The greatest interest attaches to the chemical constituents of the cyst contents. They usually consist of a highly albuminous fluid which contains in addition a peculiar substance named pseudomucin. This substance varies in amount in different cysts, sometimes constituting almost the entire cyst contents, and again it is present only in small quantities. Small cysts with colloidlike contents are the richest in this susbstance. Pseudomucin is a glycoproteid, and differs from mucin in not being precipitated by acetic acid. It is further characterized by setting free a copper reducing substance when boiled in the presence of dilute mineral acid.

Test for Pseudomucin.—The following is the test proposed by Pfannenstiel and is a modification of Hammarsten's test. To the cyst contents is added twice their volume of alcohol after which the mixture is well shaken. The *precipitate* is then filtered and well washed with alcohol, after which it is gently pressed between filter papers to remove the excess of alcohol. A portion of the precipitate is now boiled for half an hour in a 10-per-cent solution of hydrochloric acid. After cooling, it is treated with phosphorwolfram acid until the albumin is entirely precipitated. The filtrate is filtered and tested with Trommer's or Fehling's test for sugar, and if reduction takes place, it may be concluded that pseudomucin is present.

Histologically, the wall of the cyst is made up of three layers. The outer represents the tunica albuginea of the ovary, and is covered with

germinal epithelium consisting of a single layer of low cylindrical cells. The middle layer consists of connective tissue and may contain ovarian stroma or smooth muscle fibres. This layer also contains the larger blood vessels. The inner layer consists of cyst epithelium and is covered by a single layer of peculiar mucuslike cells, cylindrical in type. According to Pfannenstiel, these cells show a special affinity for hematoxylon and eosin, and by this double stain, the nuclei, cell contents, and periphery, are clearly differentiated.

When stained, they appear as high cylindrical cells with small basal nuclei, while the cell body consists of a clear transparent mass inclosed within the cell wall, which appears as a faint outline. Occasionally, the cyst wall contains small ductlike tubes or glands, which originate in a proliferation and invagination of the cyst epithelium into the wall of the cyst. Frequently, instead of ductlike invaginations, their mouths will have become occluded from constriction of the connective tissue of the cyst wall, which is also in a state of proliferation, when they will appear as small cysts. The constant repetition of this process of epithelial proliferation throughout the tumour, together with the increasing contents from increased area of epithelial secreting surface, is responsible for its growth (Fig. 257).

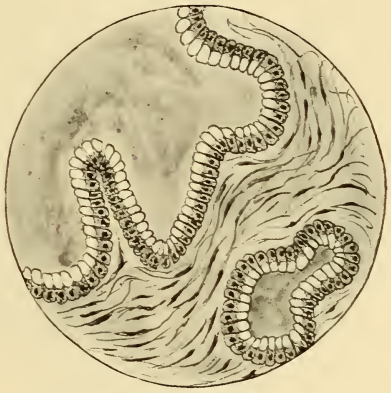

Fig. 257 (Whitacre).—Epithelium of a pseudomucinous cyst.—Rothrock.

Papillary cysts, according to Pfannenstiel, develop in the following manner: First, a proliferation of epithelium takes place which causes tilting and displacement from crowding of the cells, carrying with them a thin underlying stratum of connective tissue; this, being rich in blood vessels, also takes on proliferation. In many instances, the connective-tissue proliferation appears to surpass the proliferation of the epithelium, which must, however, always be considered primary.

Serous (Proliferating) Cysts.—Serous cysts are much less common than the pseudomucinous variety, occurring in the proportion of about 1 to 8 of the latter. As a rule, they are small, and never reach the enormous dimensions of pseudomucinous cysts, although cysts the size of a pregnant uterus at term have been observed.

In external appearance, they resemble somewhat pseudomucinous cysts. In contrast with pseudomucinous cysts they frequently develop bilaterally. While they may lie free in the peritoneal cavity, attached by a well-formed pedicle, they frequently develop within the folds of the broad ligament, and show a special tendency to become attached to the neighbouring viscera by adhesive bands.

On section, these cysts are also multilocular, though, as a rule, they seldom contain so many cysts as the pseudomucinous variety. A certain proportion of serous cysts, especially the larger ones, may appear macroscopically as unilocular cysts, but microscopic examination will invariably reveal the presence of small cysts within the walls of the tumour. As a rule, these cysts contain papillary growths, and they represent the type of proliferating papillary cysts of the old classification, just as the glandular type is represented by the pseudomucinous variety. Occasionally, however, serous cysts may be of the glandular type and contain no papillary growths.

Papillary growths may be very abundant, and may completely fill smaller cyst cavities, and even cause rupture by pressure from increased contents, or they may grow through the wall of the cyst causing perforation. Not infrequently, serous cysts are encountered with papillary growths on their surface as well as in their interior (Fig. 258). These may grow direct from the germinal epithelium, or may represent a continuation of intracystic papillary growths which have penetrated the wall of the cyst. Such cysts are almost invariably accompanied by ascites.

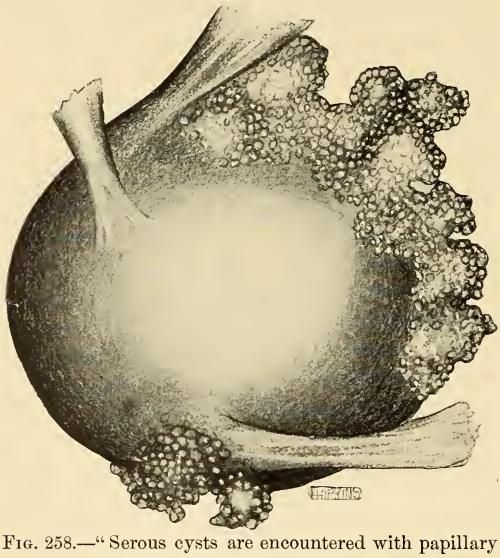

Fig. 258.—"Serous cysts are encountered with papillary growths on their surface."—Rothrock.

The contents of serous cysts consist of a thin, clear, straw-coloured or greenish fluid, rich in albumin but containing no pseudomucin. It is partly derived from cell secretion and partly from transudation from the blood vessels.

Histologically, the wall of serous cysts, as of pseudomucinous cysts, is composed of three layers, differing only in the inner layer which is lined by columnar ciliated cells. The papillary growths often present on microscopical section the most picturesque forms, usually consisting of rather scant connective-tissue stalks with branching processes extending in every direction from the main trunk (Fig. 259). The epithelium covering the papillary growths is the same as that lining the cyst. Not infrequently, deposits of lime salts are to be seen in the papillomatous growths, often presenting a concentric layer arrangement; they are termed psammoma.

Superficial Papilloma of the Ovary.—Occasionally, noncystic ovaries

are covered with papillomatous growths, which are similar in their gross appearances and anatomic structure to those found in cysts. Frequently, they completely cover the ovary, so that it appears as a papillomatous mass which may reach the size of an orange. These growths may originate from perforation of small cysts which become filled with papillomatous growths and afterward spread over the surface of the ovary; or they may grow directly from the germinal epithelium, which is perhaps the more common mode of origin. They are frequently bilateral, or may occur in company with a papillomatous cyst of the other ovary. Histologically, their structure does not differ from that of papillary growths occurring in cysts. They are invariably covered with ciliated epithelium.

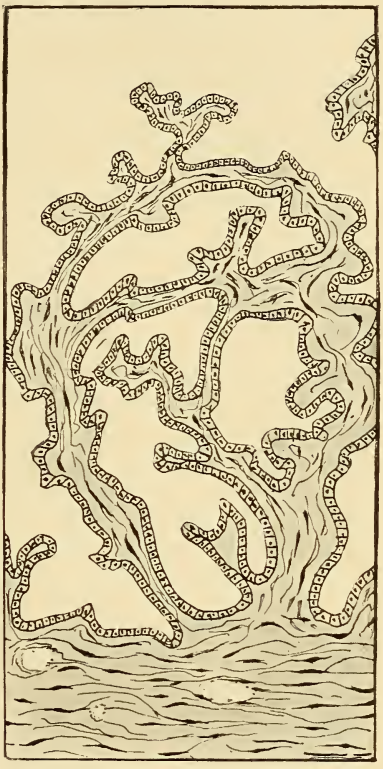

Fig. 259 (Whitacre). — "The papillary growths often present on microscopical section the most picturesque forms." — Rothrock (page 608).

Histogenesis. — The origin of proliferating cysts of the ovary is still a matter of much controversy, although the investigations of many competent observers in recent years, have done much to throw light upon this obscure subject. Formerly all ovarian cysts were believed to originate in the Graafian follicle. Virchow, after a careful investigation of colloid cysts, concluded that they were of connective-tissue origin, the result of colloid degeneration of the stroma of the ovary, and that the colloid mass constituting the cyst contents was the product of degeneration.

The excellent work of Klebs and Waldeyer in determining the epithelial origin of cysts, has placed the subject of histogenesis on a firm basis. They advanced the theory that proliferating cysts originated from Pflüger's tubes. More recent investigations have shown, however, that epithelial neoplasms have their origin, not in the embryonal Pflüger's tubes, but in tube or glandlike formations occasioned by a tilting in, and subsequent invagination of, the germinal epithelium into the ovarian stroma, which from the beginning must be regarded as neoplasms. According to Pfannenstiel, this dipping in of the germinal epithelium is not to be considered in the same light with embryonal misplaced epithelium in the sense of Cohnheim's theory,

but rather as the result of certain pathologic changes which the germinal epithelium undergoes. Until comparatively recently, the germinal epithelium was considered the sole source of proliferating cysts, but evidence begins to accumulate that they may, and often do, originate in the Graaffian follicle.

The careful researches of Flaischlen, Bulius, Steffeck, Frommel, Pfannenstiel, Williams and others, seem to prove beyond doubt, that under certain conditions the membrana granulosa of the follicle may undergo pathologic change and be replaced by cylindrical epithelium, from which cysts may develop in a manner analogous to those developing from the germinal epithelium. Williams, after an exhaustive study of the histogenesis of papillary cysts, concludes: (1) that the Graafian follicle is probably the usual starting point of papillary cysts, and, according as the membrana granulosa is transformed into ciliated epithelium or not, so will the cyst be lined with ciliated or non-ciliated epithelium. (2) That the germinal epithelium is perhaps the most frequent source of superficial and multilocular papillary cysts.

On the other hand, Pfannenstiel has shown that serous or ciliated cysts may develop from the germinal epithelium, it having first undergone pathologic change, becoming ciliated; and he regards this as the usual orgin of such cysts, while von Velits entertains the view that most ciliated cysts have their origin in the Graafian follicle.

According to Pfannenstiel, pseudomucinous cysts usually originate in the Graafian follicle.

The theory advanced by Marchand, that ciliated cysts may originate from tubal epithelium, still remains to be proved. To summarize, therefore, it may be said that both pseudomucinous and serous cysts may have their origin in the germinal epithelium or in the Graafian follicle.

Metastasis.—Both varieties of proliferating cysts may give rise to metastasis. While pseudomucinous cysts are usually classed with benign tumours, occasionally metastases have been observed, especially occurring in the peritoneum, which must be regarded as implantation metastases. They have most frequently been noted in cysts with papillary growths, and they tend to develop underneath the peritoneum in the form of cystic growths containing gelatinous masses, and have been termed pseudomyxoma peritonei (Werth). They most frequently follow spontaneous rupture of cysts, thus allowing the cyst contents to escape into the peritoneal cavity, though they have been observed to follow operation for the removal of cysts, when they must be regarded as implantations occurring at the time of operation.

Various explanations have been advanced in explanation of implantation metastasis, but it is generally believed that it takes place at points where, from irritation, as from pressure or operative procedures, the endothelial lining of the peritoneum has been destroyed. These metastases are possessed of no special degree of malignancy, but are particularly prone to recur after removal.

Metastasis is much more frequently observed to follow serous cysts. The glandular form is benign and does not tend to recur after removal or to give rise to metastasis. The papillary form, however, is particularly characterized by the tendency to metastasis which occurs, according to Pfannenstiel, in the proportion of about 13.3 per cent. Metastases almost invariably occur in the peritoneum, and appear as superficial cauliflower growths. They are very persistent, and only complete and thorough removal by radical operation will effect a cure.

Malignant Degeneration.—Both varieties of ovarian cysts may undergo malignant degeneration. From the epithelial elements, carcinoma may have its origin, while sarcoma may begin in the connective tissue of the wall of the cyst. A cyst can only be said to have undergone carcinomatous degeneration when the carcinoma is localized in small areas while the remainder of the tumour presents no evidence of malignancy. In case the carcinomatous process is widespread, the tumour must be classed as primarily carcinoma. (See Carcinoma of the Ovary.)

Sarcomatous degeneration of the wall of ovarian cysts has been only rarely observed. Cases have been reported by Pfannenstiel, E. Fränkel and Kelly. It may occur in the form of a nodule or as a diffuse infiltration of a considerable area of the cyst wall.

Dermoid cysts, as the name implies, are tumours containing structures resembling skin. They are the least frequent of ovarian cysts, occurring, according to Olshausen, in the proportion of about 3.5 per cent. They are usually small, seldom reaching a size larger than a man's head. They are commonly unilateral, though bilateral tumours are by no means infrequent. Gebhard, among 107 cases, found 16 bilateral. In most instances, they present a smooth external surface, though they may be irregular in outline and be attached to the surrounding structures by adhesions. Generally they are attached by a well-formed pedicle, and only rarely do they develop within the folds of the broad ligament. In the majority of instances, they appear as simple cysts, though close examination will frequently reveal the remains of septa or small cysts within the tumour walls.

The cyst contents vary in consistence. In pure dermoid cysts they consist of an oily fatty substance, frequently resembling vernix caseosa, which thickens on cooling. It often contains loose hair, which is usually rolled in balls, besides caseous masses that are accumulations of sebaceous matter (Fig. 260).

On section, a typical dermoid cyst is unilocular. More frequently, however, dermoid cysts are combined with proliferating cysts in which one or more of the cyst cavities contain dermoid structures. According to Pfannenstiel (Veit's *Handbuch*, vol. iii, p. 366), they are most frequently combined with pseudomucinous cysts, and very rarely with serous papillary cysts.

The outer layer of the cyst wall is fibrous and usually thin, while the inner layer consists of a structure resembling skin, from which

are frequently found growing appendages of the skin, as hair, teeth, occasionally nails; and in them are developed sweat and sebaceous glands (Fig. 261).

Between this layer and the outer cyst wall, is usually found a structure resembling adipose tissue, which consists largely of fat and con-

Fig. 260.—"It often contains loose hair . . . besides caseous masses."—Rothrock (page 611.)

nective tissue; in it are often found bone, smooth muscle, more rarely nervous tissue, cartilage, and, in a few instances, glandular structures resembling the mammary and thyroid glands have been observed. Very rarely, structures corresponding to the intestinal or respiratory tract have been observed. In these structures, Wilms has recognised an attempt at reproduction of the three embryonal layers—namely, those growing from the ectoderm including skin and appendages; those from the mesoderm consisting of fat, connective tissue, bone, muscle and nervous tissue; and endodermal structures resembling intestines and respiratory tract.

As a rule, dermoid structures are found only in a small area of the cyst wall appearing as a nodular raised prominence, which is covered with hair and may contain teeth or bone. The hair in dermoid cysts is as a rule short, though it may, rarely, reach a length of several feet. It is usually of a reddish brown or blonde colour, which is uniform throughout the cyst. Teeth are usually irregularly shaped, often rudimentary, and as a rule only a few are present, though as many as 300 have been reported. They are generally incisors or molars, and are set with their crowns pointing toward the axis of the body. Not infrequently, they are set in bone resembling rudimentary jaws. The bones found in dermoid cysts simulate those which lie in positions near hair-covered skin, as the maxillary bones, bones of the cranium,

or pubic bones. Less frequently, bones resembling long bones have been observed, such as ribs, phalanges of fingers or toes, and even joint-like formations with cartilaginous covering have been described. Rarely, brainlike formations have been observed, and in a few instances, also, structures simulating the eye, with retinal pigment.

Histologically, dermoids are of the greatest interest from the wonderful variety of structures they contain. Almost every tissue or organ in the body may find its prototype in the structures of a dermoid cyst, though often, it is true, in a more or less rudimentary state.

Until comparatively recently, the theory most generally accepted in explanation of the origin of dermoids, was that of inclusion. At the present time, the ovulogenous theory, proposed by Wilms, finds most adherents. In proof of its correctness, there has been advanced the finding of structures in dermoids, corresponding to the three em-

Fig. 261 (Gebhard).—"In them are developed sweat and sebaceous glands."—Rothrock (page 612).

bryonal layers, which is characteristic of ovarian dermoids alone, as compared with those occurring in other regions of the body. In further support of this theory, the fact that they are sometimes met with in the fœtus makes it appear that they have their beginning in early life, and that the ovum possesses all the requisites necessary for the development of the many structures present in dermoid cysts.

Malignant Degeneration.—Dermoid cysts may undergo sarcomatous or carcinomatous degeneration (Fig. 262). Sarcoma usually develops in the wall of the cyst.

Well-authenticated carcinoma beginning in dermoids has been observed in a few instances. It was formerly believed that it was always epidermal in character. Recently, however, Yamigiva found a glandular carcinoma which he believed to have originated in a pseudo-mammary gland.

Fig. 262.—"Dermoid cysts may undergo . . . carcinomatous degeneration."—Rothrock.

Teratoma.—Teratomata are tumours closely related to dermoids in their histogenesis, but differing in their structure and appearance. They are very rare, as compared with dermoids, and are solid tumours, or are at least made up largely of solid structures. They are usually unilateral and may reach enormous size. The tumour consists of a conglomeration of embryonal elements resting on a fibrous structure, or stroma, which is rich in blood vessels. They are inclosed in a fibrous capsule, in which may, at times, be found the remains of ovarian stroma. Histologically, they contain the same embryological elements as dermoids.

Solid Tumours.—*Fibroma of the Ovary.*—Fibroma belongs to the rarer ovarian tumours, its frequency being, according to the estimate of Pfannenstiel, between 2 and 3 per cent. It is probable that a number of tumours heretofore described as fibroma were in reality fibro-sarcoma.

As a rule, their surface is smooth, though often irregular in outline, and they are usually attached by a pedicle, but may develop within the ligament (Fig. 263). They are usually unilateral, though they may be bilateral. In size, they vary from that of a walnut to that of a man's head, and may rarely weigh as much as 30 or 40 pounds. Usually no ovarian structure can be recognised. They vary in consistence. When the tumour consists of pure fibroma it is firm. Occasionally, the tumour may be cystic from the presence of dilated lymph or blood vessels, or cystic cavities may result from degeneration or necrosis.

Fibroid tumours of the ovary may undergo fatty or myxomatous degeneration, or contain calcareous deposits.

Histologically, they are composed of fibrillary connective-tissue bundles which run in all directions, and smooth muscle fibres may be present, though as a rule they are scanty (Fig. 264).

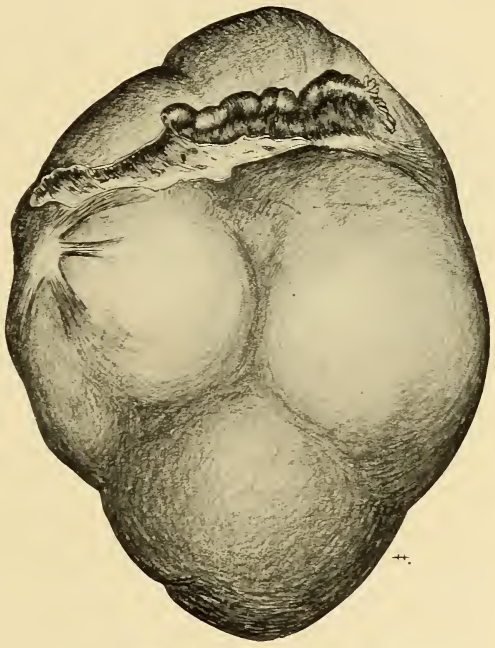

Fig. 263 (Martin).—"As a rule, their surface is smooth, though often irregular."—Rothrock (page 614).

Rarely, combinations with other tumours are observed, as with adenoma and sarcoma, and the former may degenerate into carcinoma or develop cystic cavities containing colloid substance. When smooth muscle is present, the tumour is properly termed fibromyoma. A few cases of pure myoma of the ovary have been described, but they are very rare.

Calcified tumours of the ovary have been observed from time to time; they have generally been regarded as osteomata, but the careful investigations of Whitridge Williams have established the fact that they contain no bony tissue. Schlenker published a description of this condition about the middle of the eighteenth century, and was followed a few years later (1760) by Le Clerc de Beaucoudray, with a description of an ossified ovary. From that time until the present, numerous similar descriptions have appeared, all of them obviously based upon the original misconception as to the true character of the growth. The process of calcification may (*a*) occur in the ovarian stroma; or (*b*) be restricted to the Graafian follicle.

Calcareous Tumours of the Ovarian Stroma.—These growths, if such they may be called, are generally small, the ovary containing them rarely exceeding 7 centimetres in its longest diameter. In one case examined by Williams the ovary revealed many cicatrices, but no adhesions, upon its surface. On section, one end was found to be occupied by a hard roundish nodule 12, 16, and 18 millimetres in its various diameters (Fig. 265). This nodule occupied an apparent capsule with which it was connected by numerous connective-tissue bands. On

sawing through the nodule, which was of bony hardness, its cut surface presented a mottled appearance and the general colour of bone. At one side of the ovary were found the corrugated walls of an old corpus luteum, about 13 millimetres in diameter. Here and there were seen several follicles with clotted contents. On the other side, the ovary revealed a hard large nodule measuring 7, 6, and 5 centimetres in its various diameters. From the anterior and inner surface of the ovary there developed a number of small pedunculated fibromata, the largest being 6 millimetres in diameter. From the neighbourhood of these small fibromata, the ovarian tissue covering the hard nodule began to decrease in thickness, soon becoming as thin as a sheet of paper. This thin capsule was perforated in a number of places, through which perforations the surface of the hard mass was visible. This mass weighed 220 grammes, was extremely hard, and resembled ivory in its general consistence. When thrown upon a hard surface it rebounded like a billiard ball. On section, its surface was mottled, presenting an appearance similar to that of the smaller nodules of the other ovaries.

Fig. 264 (Whitacre).—"They are composed of fibrillary connective-tissue bundles which run in all directions."—Rothrock (page 615).

Dry sections of both masses revealed no trace of bony structure. Microscopical sections made after decalcification by a 10-per-cent solution of nitric acid, showed that both masses were identical in structure. They were composed of typical fibrous tissue made up of bundles of dense connective tisuse, which interlaced in all directions, and possessed but few long nuclei. The tissue resembled that found in the hilum of the ovary, except that it was poorer in blood vessels, and contained more veins than arteries. Scattered all through it, were irregular-shaped areas of various size, which stained deeply with hematoxylin.

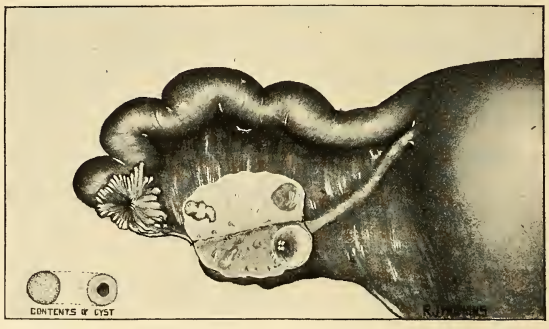

Fig. 265.—"On section, one end was found to be occupied by a hard roundish nodule."—Reed (page 615).

They generally presented sharply marked contours, and, in their interior, revealed signs of striation, but no trace of nuclei could be found within them. Here and there, under a high power, could be seen individual cells which had lost their nuclei and presented the typical appearance of coagulation necrosis. Single cells, each containing a calcareous granule, and others which were entirely calcified, were observed. The general mass had manifestly developed by a process of cell coalescence.

Calcareous tumours of the corpus luteum have been observed by Bland Sutton, Coe and others. Coe's case was examined and reported upon by Whitridge Williams substantially as follows: The ovary was 5 centimetres long and 2.5 centimetres deep; on its surface were numerous cicatrices but no adhesions; in its centre was a hard mass 12 millimetres in diameter, of bonelike consistence. When sawn through, it was seen to consist of two portions, a soft pinkish central portion, and a hard bonelike outer portion, 2 millimetres thick, and of a distinctly yellow colour. The central portion of the nodule resembled partially organized blood clot. The rest of the ovary presented a normal appearance. Microscopic examination after decalcification and section of the mass, revealed no signs of osseous structure. The decalcified sections stained poorly, but the hard exterior of the nodule stained readily with hematoxylin and presented a more or less homogeneous granular appearance, in which it was impossible to distinguish nuclei. This tissue was surrounded by typical ovarian stroma, which also stained poorly. The central portion of the nodule was composed of dense fibrous tissue which was very poor in cells. Between this and the decalcified portion, were layers of small cells, possibly corresponding to the membrana granulosa, though it is impossible to state their origin with certainty. In the surrounding ovarian stroma were numerous round stellate crystals, which were thought to be the result of the decalcification. The specimen was looked upon by Williams as in all probability representing a calcification of the large cells which surround a ripe Graafian follicle and form the yellow margin of the corpus luteum.

The *causes* of calcification within the ovary probably do not differ in general from those producing that condition in other parts of the body. The deposit of calcareous salts, first, in foci which, coalescing, form the larger masses, is recognised by Cohnheim, Litten, and Whitridge Williams, as following only certain varieties of necrosis, particularly those characterized by coagulation. The calcification of necrotic areas is explained by the chemical affinity which exists between the necrotic tissue and the calcium salts circulating in the blood, probably as a soluble albuminate. It is assumed that the soluble albuminate, by virtue of chemical affinity, mingles with the material of the dead cells forming an insoluble albuminate of lime which is deposited in them. That this general law of calcification is operative within the ovary, becomes apparent when it is remembered that that organ is liable

to fibroid changes, to displacements, and to other mechanical interference with its circulation, all of them calculated to induce more or less cell necrosis.

The *symptoms* of calcareous tumours of the ovary are in no sense characteristic. The *diagnosis* of this condition has probably never been made before operation. There is, therefore, no special *treatment*, other than that which applies to other solid tumours of the ovaries. When discovered they should be removed. (See Ovariotomy.)

Hematoma of the Ovaries.—Follicular hemorrhage is of common occurrence, being due to the rupture of vessels in the wall of the ovisac. But the term hematoma is usually applied clinically to tumours above the size of a hazelnut. In the case of hemorrhage into a follicular cyst, they may reach the size of a small orange. While excessive hyperæmia of the ovary may lead to interstitial hemorrhage, so-called apoplexy of the gland is probably always secondary to rupture of a follicular hematoma.

Causes and Pathology.—Venous stasis leading to the rupture of veins in the walls of dropsical follicles may be due to pelvic congestion from any cause, such as sexual excitement or excess. Its occurrence in connection with neoplasms, ectopic gestation, and abortion, is similarly explained. Hematoma is often associated with tubal disease, especially when there are many adhesions or torsions of the pedicle. General follicular hemorrhage and apoplexy have been noted as the result of profound alteration of the blood in extensive burns, phosphorus poisoning, and in the acute exanthemata. An ovary which is the seat of general follicular hemorrhage, is enlarged to two or three times its normal size, dark red nodules as large as a pea or marble appearing on its surface. On section, these are seen to be circumscribed collections of semifluid blood or coagula in various stages of absorption. Or a single tumour may include almost the entire ovary, only a small portion of the stroma remaining. The usual changes occur in the blood until only a clot or mass of fibrin is found. The cyst may become infected through its proximity to the gut or Fallopian tube. The internal pressure may become so great that it ruptures, and an intraperitoneal hematocele develops; but it is doubtful if sufficient blood ever escapes to endanger life.

Symptoms and Diagnosis.—In spite of the statements in text-books, it is questionable if the symptoms of ovarian hematoma are sufficiently characteristic to warrant a positive diagnosis; in fact, the condition is usually found on opening the abdomen for supposed inflammatory disease. The sudden occurrence of severe throbbing pain in the region of the ovary, with marked enlargement and tenderness, but without rise of temperature, in connection with conditions leading to excessive pelvic congestion, would point to a rapid effusion of blood into a follicle. The sudden enlargement of a pre-existing cystic ovary would be still more significant. Should the cyst rupture, the usual symptoms of intraperitoneal hemorrhage would develop, though it

would be exceedingly difficult to diagnosticate it from early rupture of an ectopic sac. After the acute stage, or in cases of slow oozing, the symptoms are those common to ovarian disease, and are often masked by those of localized peritonitis.

Treatment.—The treatment of acute hemorrhage consists in rest, ice-bags, low diet, regulation of the bowels, and the avoidance of any influences tending to increase pelvic congestion. True hematoma of the ovary is a surgical condition, and calls for removal of the affected ovary, or of the blood sac alone if a portion of healthy stroma can be preserved.

Malignant Neoplasms

Primary carcinoma of the ovary is the most common form of malignant disease of the ovary. While varying greatly in form and appearance, it admits of division into two groups, each of which is represented by a more or less distinct type.

Group I. Medullary Carcinoma.—The first group consists of solid tumours. They are of more or less firm consistence, usually rounded or oval in shape, though often irregular in outline, and frequently present a nodular or lobulated appearance. They vary in size, rarely, however, exceeding that of the head of a newborn child. As a rule they form their attachment by a short thick pedicle, and usually they lie free in the abdominal cavity; only very rarely have tumours been observed which were partially intraligamentary. Not infrequently, they are bilateral though unilateral development is the rule.

They are inclosed in a dense fibrous capsule, and, on section, present a more or less homogeneous surface of yellowish or gray white colour (Fig. 266). Frequently, in softer tumours, the appearance is brainlike. Occasionally, the tumour will have a mottled appearance from extravasations of blood into the tumour substance, which, if recent, may be coagulated, or if of long standing, may appear as an extravasation cyst simulating those often found in cerebral hemorrhage. Degeneration changes are of common occurrence, especially caseous and fatty changes, with resulting softening and the formation of cystlike cavities. The contents of such cysts are turbid and of a yellowish colour, while their walls present an irregular and uneven outline. Histologically, they are composed of a more or less diffuse infiltration of a fibrous stroma with carcinomatous cells. In some instances, the fibrous stroma predominates, forming alveoli which are filled with carcinomatous cells. More frequently, however, the microscopic appearance is that of a diffuse infiltration of the rather sparse fibrous stroma, so that the cellular ele-

Fig. 266 (Gebhard).—"They are inclosed in a dense fibrous capsule."—Rothrock.

ment constitutes the greater part of the tumour, in which case it is termed medullary carcinoma.

Group II. Adenocarcinoma.—The second group consists of cystic tumours which bear a striking resemblance in their external appearance to serous cysts. They are rounded or oval tumours, and rarely exceed in size an adult's head, being usually smaller. They are generally attached by a short pedicle, though they may develop within the ligament, and are frequently adherent to the surrounding viscera. Like serous cysts, they are often bilateral and are usually multilocular, though they may at times appear unilocular.

According to Pfannenstiel, papillary growths are observed on the external surface of the cyst in about half the cases. On section, the cyst wall is composed of connective tissue which is often quite friable. Frequently the wall of the cyst is very much thickened in spots from the development in it of carcinomatous nodules. Growing from the internal surface, may usually be seen papillary and cauliflower growths at times almost filling the cyst cavity. The cyst contents may be clear, but more frequently they are turbid from the presence of cellular elements, or they may be blood-tinged from hemorrhage into the

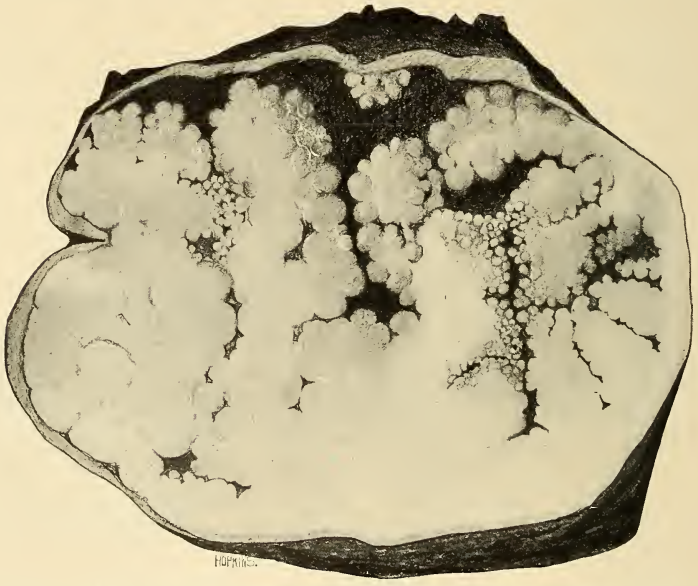

Fig. 267.—"Cystic carcinoma of the ovary is almost invariably papillary."—Rothrock.

cyst. Cystic carcinoma of the ovary is almost invariably papillary (Fig. 267). The papillary growths are often similar in appearance to those of the papillary cysts, still, on section, their carcinomatous nature may often be recognised by the naked eye.

Histologically, they belong to the adenocarcinomata, and often the same tumour presents a great variety of structure. The solid masses,

which are found in the wall of the cyst, may consist of a diffuse infiltration of a medullary character. More frequently, however, such nodules and cauliflower growths are not really solid but are made up of papilla and glandlike formations, the lumen of which is still plainly visible. Everywhere an atypical proliferation of epithelial cells is present, and in papillary growths, instead of being covered with a single layer of cells as in cystadenoma, the epithelium will be replaced by several layers of cells asymmetrically arranged (Fig. 268). The same peculiarity is observed in the glandlike formations in which, instead of being lined with a single layer of cells, the lumen will frequently be filled with a proliferation of cells giving it an alveolar appearance.

Fig. 268 (Whitacre).—"Everywhere an atypical proliferation of epithelial cells is present."—Rothrock.

Not infrequently, lime salts become deposited, especially in the papillary growths, with the formation of psammoma. Between cystadenoma (Fig. 269) and this type of primary carcinoma, every gradation exists, and so gradual is the transition that it is not always possible to distinguish between them. Ziegler (*Pathologische Anatomie*, page 335) admits that no sharp dividing line can be drawn between adenomata which are benign and those which are malignant.

Pfannenstiel estimates that fully one half of all papillary tumours of the ovary belong to the carcinomata, but, according to his view, almost all cases which ultimately become carcinomatous should be classed as primary carcinoma. The adenoma from which the carcinoma develops, he regards as representing an intermediary stage, but at the same time he admits that there is no means of distinguishing it from benign adenoma. Most authors, however, take a middle ground, and regard a considerable number of such tumours as carcinomatous degeneration of primary benign tumours.

The microscopic evidence of malignant change consists in a proliferation of the epithelial cells with atypical arrangement, as, for example, instead of the uniform single layer of epithelium are to be seen masses of cells, asymmetrical in their arrangement, and tending to form several layers (Fig. 270).

Metastasis is of frequent occurrence, tending to involve first of

all the peritoneum, next the omentum, liver, stomach, intestine, and occasionally, the pleura. Where the disease is unilateral, the ovary on the opposite side is frequently the seat of metastasis, and Steffeck has often found it to contain metastatic deposits, when macroscopically it

Fig. 269 (Whitacre).—Cystadenoma.—Rothrock (page 621).

appeared normal. Heinrichs observes, also, that bilateral development is commonly the result of metastatic involvement from one ovary to the other.

Secondary carcinoma of the ovary is rare, and usually follows carcinoma of the uterus, especially of the body. It has, however, been observed to follow carcinoma of the stomach and mammary gland, the result of metastasis. Like other epithelial neoplasms of the ovary, primary carcinoma may have its origin in the Graafian follicle or in the germinal epithelium.

Sarcoma of the ovary is of much less common occurrence than carcinoma. Cohn estimates the frequency as compared with ovarian cysts at 1 per cent, and as constituting 10 per cent of malignant tumours of the ovary. On the other hand, Pfannenstiel, in 400 ovariotomies, found sarcoma of the ovary in the proportion of 5.38 per cent. With these, however, he included endothelioma.

Primary sarcoma of the ovary may occur at any period of life, in childhood as well as in advanced age, and Doran has observed it in-

volving both ovaries of a seven months' fœtus. It appears to be more frequently met with, however, between the ages of twenty and thirty. It is frequently bilateral, though, as Heinrichs observes, this may sometimes be the result of metastasis, only one ovary having been primarily involved.

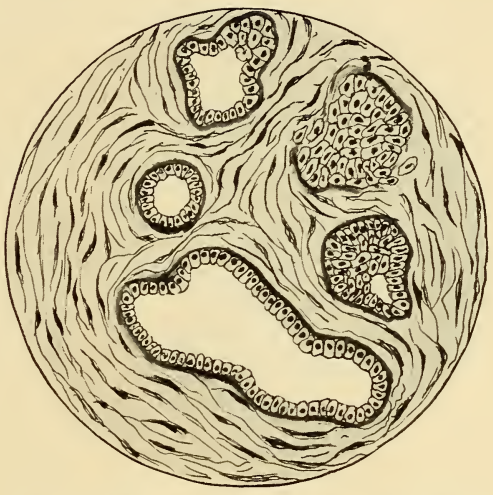

Fig. 270 (Whitacre).—"The microscopic evidence of malignant change consists in a proliferation of the epithelial cells with atypical arrangement."—Rothrock (page 621).

Sarcoma belongs to the solid tumours of the ovary, and is usually rounded or cylindrical in shape with a smooth surface, though it may be irregular in contour, presenting a nodular appearance. The size of the tumour varies and may sometimes reach a weight of 20 to 30 pounds or more, if left to run its course without surgical intervention. Usually, however, the presence of the tumour is manifested by symptoms before it attains a great size. The consistence of the tumour depends upon its histologic structure. If made up largely of spindle cells, it will be firm, resembling fibroma, whereas, if composed chiefly of round cells, it will be soft, and often of brainlike consistence. Frequently, these tumours contain much fibrous tissue, when they are called fibrosarcoma.

Usually, the entire ovary is replaced by the tumour mass, though, occasionally, the remains of ovarian tissue may still be seen on its surface. The tumour is commonly surrounded by an outer wall, which is in many instances so thin and delicate that the fingers may be thrust through it. These tumours are usually attached by a short pedicle, and are seldom adherent to the neighbouring viscera, but are frequently accompanied by ascites. On section, they represent a yellowish white, gray, or pink surface, the colour depending on their structure and blood supply. Cyst formations are by no means infrequent, and are usually the result of hemorrhagic infarcts or extravasations of blood into the tumour substance with subsequent softening, or of fatty degeneration of the tumour cells. Histologically, sarcoma consists of a diffuse infiltration of the ovarian stroma by sarcoma cells, the variety most commonly found being round or spindle cells (Fig. 271). Frequently both round and spindle cells are present in the same tumour.

In the order of malignancy, the small round-celled variety stands first, while fibrosarcoma appears in many instances to be relatively benign.

Rothrock has observed a case of spindle-celled sarcoma involving both ovaries, in which the patient died of metastasis to the peritoneum six months after operation for their removal.

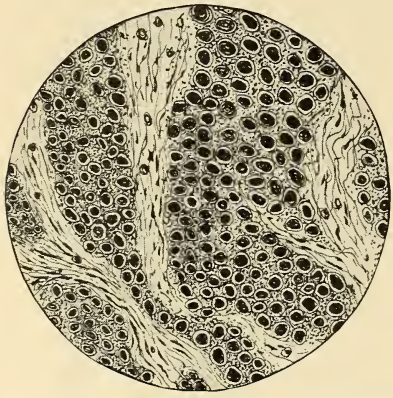

Fig. 271 (Whitacre).—"Sarcoma consists of a diffuse infiltration of the ovarian stroma by sarcoma cells." — Rothrock (page 623).

Metastasis to other organs of the body occurs, acording to Temesvary, in the following order of frequency: peritoneum, omentum, stomach, pleura, lungs, uterus, liver, diaphragm, kidney. Sarcoma of the ovary frequently undergoes degenerative changes, the most common of which, are myxomatous and fatty degenerations.

Endothelioma of the Ovary.—Occupying an intermediate place between carcinoma and sarcoma, there is a group of malignant tumours of the ovary possessing many of the clinical features of both, but differing from them in anatomic structure.

Leopold, first, in 1874, described a case under the name of lymphangeioma cystomatosum. Tumours of similar structure had, previously to this, been frequently observed occurring in other regions of the body, and were called angeiosarcoma and lymphangeiosarcoma.

Marchand, in 1879, was the first to give a detailed description of these tumours and to distinguish them from both carcinoma and sarcoma, in spite of the great similarity in many respects to the structure of both. He named them endothelioma, thus denoting their origin from the endothelium of the blood or lymph vessels. Since then, tumours of the same kind have been described by different authors, so that we may now form some conclusions concerning the most important features of these growths.

Endothelioma of the ovary is, in most instances, a solid tumour (Fig. 272). It has been met with most frequently in middle age or beyond it, though Leopold has observed it in an eight-year-old girl, and Olshausen in a girl seventeen years of age.

These tumours vary in size from that of a closed fist to that of a man's head, and are usually unilateral, though bilateral tumours have been observed. In shape, they are commonly rounded, or they may be multinodular or lobulated. The surface of the tumour may be smooth or rough, and its consistence firm or soft. Usually the tumour is attached by a short pedicle, and it frequently forms adhesions to the surrounding structures.

On section, the cut surface is of a yellow, gray, or white colour, often brainlike in appearance and consistence, and easily torn by the finger. Frequently, it is made up largely of fibrous structure in which are present nodular areas of softer consistence. Again the tumour may be composed of numerous small cysts in a rather dense stroma, thus giving it a honeycombed or worm-eaten appearance (Pick). In other instances, the tumour appears cavernous, or may be laminated in structure. Cyst formation occurs chiefly in the lymphatic variety. Rarely, papillary formations have been observed within the cyst, the histologic structure of which is fibrous. These tumours have their origin in the endothelium of the blood and lymph vessels, and, histologically, they present the greatest variety of structure (Fig. 273).

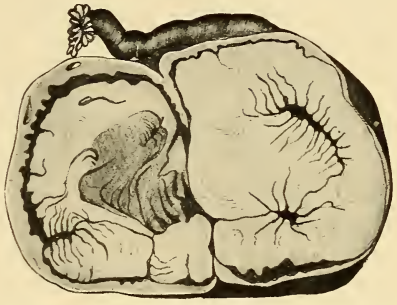

Fig. 272.—"Endothelioma of the ovary is in most instances a solid tumour."—Rothrock (page 624).

Pick has distinguished three types:

(1) A rosarylike form, consisting of chains of cells arranged in rows, lying in narrow spaces or clefts in the stroma; their borders run parallel, and they frequently anastomose with each other or send off branches.

Fig. 273 (Whitacre).—"Histologically they present the greatest variety of structure."—Rothrock.

(2) The second consists of glandlike formations which, on transverse section, furnish a picture often difficult to distinguish from adenocarcinoma, as the lumen of these glandlike spaces is often encroached upon by several layers of polymorphous cells.

(3) The third form consists of a histologic formation resembling alveolar sarcoma, and appears as groups of rounded epithelioid cell bodies filling alveolalike spaces in the rather dense fibrous stroma. Not infrequently, all three types may be found in the same tumour.

Endothelioma is frequently found in combination with other tumours of the ovary. The cases of Eckhard, Flaischlen, and Pomorski, were cystic, and contained dermoid structures, while Pfannenstiel has observed a combination of endothelioma with true epithelial cystadenoma. They are very prone to undergo degenerative changes, the most common being hyaline and myxomatous degeneration, while colloid and fatty degeneration have also been observed.

Clinically, they are malignant. In a case of Leopold's, which was unsuited to operation, the patient died of cachexia within six months.

As regards recurrence following operation, there are only scanty data available upon which to base an opinion. Of 7 cases tabulated by von Velits, only 2 recovered from the operation. In 2 cases, metastasis was observed, while 4 had pronounced cachexia. Billroth regarded these tumours as in the same order of malignancy as carcinoma.

CHAPTER XLI

NEOPLASMS OF THE OVARIES (Continued)

Complications—Symptomatology—Diagnosis — Treatment — Ovariotomy: History, technique, results—Incomplete ovariotomy—Ovariotomy during pregnancy.

The complications of ovarian tumours are various as there is no reason why an ovarian tumour should not develop in the presence of any other visceral lesion. These growths occur, therefore, coincidently with neoplasms of the uterus, cysts of the mesentery, nephrydrosis, hypertrophies of the spleen, enormous distentions of the gall bladder, cysts of the urachus, etc. Among the more important complications, however, are (*a*) pregnancy, (*b*) torsion of the pedicle, (*c*) ascites, (*d*) albuminuria, (*e*) adhesions, (*f*) rupture of the tumour.

Pregnancy as a complication of ovarian tumour is not an infrequent occurrence in practice. Sir Spencer Wells, after an experience in ovariotomy greater than any which had then fallen to the lot of any other man, observed that, "certainly the most common mistakes in the diagnosis occur when the tumour is enlarged from some cause, and pregnancy is the most common of all causes of enlargement of the uterus. When a patient has no reason for deceiving her adviser, doubt or difficulty will often arise; and in cases of pregnancy, real or suspected, the patient may mislead the surgeon intentionally, or from her own hopes or fears biasing her judgment." This complication is always a condition of serious import. Pregnancy is liable to give a fresh impetus to the growth of a tumour, while the tumour, in turn, may exercise a deleterious influence upon the gravid uterus. Abortion is not an infrequent sequence. If the case goes to term, rupture of a thin-walled cyst is liable to occur as the result of the muscular contraction of the abdominal wall. Inflammation resulting in adhesions between the cyst and either the intestines or abdominal wall, or both, may be induced. Twisting of the pedicle may occur as the result of the changed position of the cyst following the collapse of the parturient uterus. Gottschalk (*Frauenarzt*) has reported a case of infection of the cyst by the colon bacillus, and Zetter has reported 21 cases of cyst infection occurring during the puerperium.

The mortality, both maternal and fœtal, is very high in these cases when left to themselves. Heiberg found that 25 per cent of mothers, and 75 per cent of children, died in 271 cases in which pregnancy, coexisting with ovarian tumour, was permitted to go to term. Zetter

gives the maternal death-rate at about 30 per cent, while Litzmann places it at 43 per cent.

Torsion of the pedicle, as the result of axial rotation of the tumour, occurs with sufficient frequency, and is a complication of such gravity, as to entitle it to consideration in this connection. Knowsley Thornton found a twisted pedicle 57 times in 600 cases of ovariotomy. It is a complication to which Rokitansky first called attention in 1865. He described 13 cases, 8 of them having been encountered in post-mortem examinations made in 58 cases of ovarian disease. Sir Spencer Wells, Kolb, Peaslee, and Barnes, were among the early observers of this complication.

The *causes* of axial rotation of ovarian tumours have been the subject of repeated speculation. Tait advanced the theory that descending masses of fæcal matter caused the tumour to turn. Doran believes (*Tumours of the Ovary*) that the twisting of a pedicle is to be explained by the simpler doctrine that the tumour, pressed upon by the viscera, and even by the costal cartilages above and the pelvic structures below, but comparatively free laterally and anteriorly, rotates on its own axis every time the patient after walking or lying on her back turns round and rests on her side. Accidents, direct violence, sudden strain, and sudden change of position, were the determining causes of the attack in 8 of Thornton's cases. Pregnancy seems to bear a causal relation to the complication. The pathologic changes are dependent upon the mechanical obstruction to the efferent circulation. The comparatively firm and relatively noncompressible arteries continue to pump blood into the tumour, while the obstructed veins can not carry it out. As a result, there is an enormous increase in the volume of the growth, accompanied by acute pain which is referred chiefly to the pedicle, a fact which Thornton considers due to the pressure to which the nerves are subjected at that point. In extreme cases, the pain extends over the entire area of the tumour. Coincidently with this turgescence of the tissues, there occurs a transudation of sanguiferous elements upon the surface of the tumour. In some cases, the blood vessels rupture either into the peritoneal cavity or into the cavity of the tumour. Secondary rupture of the hemorrhagic tumour, the blood and pseudo-mucinous contents escaping into the peritoneum, has been noted. The incised wall of a tumour the pedicle of which has been twisted, reveals numerous hemorrhages, varying from punctate clots to large hematomata. While, as a rule, these tumours perish by the necrosis induced by strangulation, there are exceptional instances in which they have survived by virtue of nutrition derived from the newly formed peripheral adhesions. These are a distinct feature of the pathologic changes observed in the majority of cases. Reed has had a case in which there was a distinct history of rotation of the tumour, but in which operation was denied because the patient was *in extremis*. After several days her symptoms began to improve, and six months later she was in good health with a tumour of diminished volume.

The *symptoms* of twisted pedicle are, sudden pain in the ovarian region, which may extend rapidly over the area of the tumour, and rapid increase in volume of the tumour, the patient manifesting signs of shock, associated sooner or later with evidences of systemic toxæmia. Vomiting may or may not be present. The diagnosis is not difficult if an ovarian tumour is known to exist. There is frequent extensive peritoneal tenderness. The treatment of this condition is by immediate ovariotomy.

The changes observable in a cyst with a twisted pedicle are, first, œdema of the cyst wall, and, next, distention of the sac. Serous exudation from the circulation, following in the direction of least resistance, takes place as a rule into the cyst cavity rather than upon its surface. A certain amount of transudation is, however, observable on the surface, a condition which favours the speedy development of adhesions. The blood pressure becomes so great that hemorrhages frequently occur, as a rule into the cavity of the cyst, but occasionally upon the surface. It is rare that the cystic fluid in these cases is not discoloured by blood elements. The blood pressure may become so great as to induce cell necrosis.

The *treatment* of twisted pedicle is incontestably by operation; "the only question admitting of discussion," says Richardson (*Virginia Medical Semimonthly*), "is that of the most advantageous time. The conditions in one case demanding operation, in another justifying it, are not unlike those seen in appendicitis and in extrauterine pregnancy. Under some circumstances intervention should be delayed for a more favourable moment; under others it can not be too prompt.

"It can not be too prompt when the lesion is recognised before shock has become profound, and before sepsis has become pronounced. Nor can it be too early when the symptoms are increasing, even if shock and sepsis are grave enough seriously to compromise the immediate success of intervention. When, however, the patient is improving, when the immediate effects of hemorrhage, of sepsis, or of both, are being recovered from, then the wisdom of intervention must be questioned. The patient must be carefully watched and a time awaited when she can safely withstand the added shock of operation. In the lesion under consideration the pulse is the most valuable guide. Whatever the other signs may be, whether the temperature be high or low, whether there be tenderness or not, whether there be distention, rigidity, vomiting, obstipation—in a word, whether there be general peritonitis or not, the tumour should be removed immediately if the pulse is good. More than this, it must be removed if it is getting worse. On the other hand, a pulse that from being bad is rapidly improving, justifies a short delay, even if other signs are bad. When all signs, from being grave, are improving, a reasonable delay is but common sense. To wait for improvement when there is no sign of improvement seems to me unjustifiable; for too often, especially in hemorrhage, there will be no improvement. The risk of intervention must be taken.

When bleeding is suspected, and when the pulse is poor or imperceptible, intravenous injections of salt solution should be made, and the utmost speed of enucleation used. In the profound shock of general peritoneal infection without hemorrhage, salt solutions may also be used, but here one must not be disappointed by failure. In hemorrhage, an infusion of salt solution into the veins adds the circulating medium needed by the flagging heart; in sepsis it simply dilutes an abundant supply of vitiated blood—in the one case it tides the patient successfully over a grave crisis; in the other it merely postpones the fatal event.

"Whether delay be practised or not, every effort should be made to add to the patient's strength. In addition to intravenous injections, stimulating enemata of hot salt solution and brandy and coffee should be given. If not vomiting, the patient should be given stimulants by mouth. Hypodermic injections of strychnine, brandy, ether, and other cardiac stimulants may be given. The whole body should be kept warm by means of hot-water bottles and hot blankets, and the foot of the bed should be elevated. While the strength is being restored in this manner, preparations for operation should be made. It is important, especially if free blood is in the abdominal cavity, that the operation be extremely aseptic, because infection is so apt to take place after hasty preparations of the operative field. Yet in advancing shock and hemorrhage it may not be possible to sterilize thoroughly the field, lest the patient die before the operation can be begun. The risk of infection from hasty and incomplete preparation must therefore be taken.

"It must not be inferred, however, that so hasty an intervention is always demanded. In all but one of the cases here reported the operation was performed after due consideration; the patient recovered fully from the initial shock, and was operated upon some time later. In but one was immediate operation performed, and in that case there was already a fatal gangrene. Hemorrhage was an important factor in but one instance."

Ascites is sometimes caused by an ovarian tumour with which it may then coexist as a complication. It is to be remembered, however, that in many of these cases, the intraperitoneal accumulation of fluid may be the result of cardiac, renal, or hepatic disease. Care should be exercised to ascertain as nearly as possible the exact condition of these organs, and their possible causal relation to the ascites. If any of them present diseased conditions they should be subjected to appropriate treatment. It is true that this treatment may sometimes need to begin with ovariotomy, for renal, hepatic, and intestinal complications may be caused in the first instance, either by direct pressure from a large ovarian tumour, or by the mechanical interference of that tumour with the portal circulation. As a rule, however, such conditions may be found amenable to treatment before ovariotomy is performed, and when this can be accomplished it should be done. Douglas

says that a small tumour, with ascites appearing early, is strongly presumptive of malignancy. If the ascites is from obstructed circulation, the liquid will be a limpid fluid resembling water, perhaps slightly coloured, containing a little albumin but no fibrin, and giving no sediment. If the ascites is from peritoneal inflammation, the liquid will be thinner but never transparent, always cloudy, looking like buttermilk, and smelling like decayed cheese. If the effusion is from simple serous irritation, the liquid will be albuminous, rather clear, though sometimes coloured like bile. In the sediment will be found elements of great importance. Large irregular cells may be seen, having a central nucleus surrounded by a quantity of granulations. The presence of these cells is usually taken as a sign of malignant growth.

Albuminuria is of frequent occurrence in connection with the larger cysts of the ovary. When the growth attains such a size that it exerts pressure upon the kidneys, albumin is almost sure to appear in the urine, the condition being practically analogous to that which is frequently found in pregnancy. If the disease has been of long standing, the changes thereby induced in the kidney may have reached the destructive degree. It is highly important, as a matter of routine, that the urine be investigated in all these cases before operation. The facts thereby elicited will have an important bearing upon the selection of an anæsthetic and upon the prognosis of the case.

Adhesions are liable to occur as the result of mechanical hyperæmia, traumatism, or infection of the tumour. Adhesions may be single or multiple, firm or friable, local or general, and may bind the tumour to either the visceral or the parietal peritoneum. Adhesions between the tumour and the intestines, the abdominal wall, or the omentum, are naturally the more frequent. While it is true that peritonitis ordinarily results in the formation of adhesions, yet, Douglas and others have reported cases in which such a result did not follow distinct inflammatory attacks. Persistent, definitely localized pain, of the traction variety, at some point of the surface of the tumour is suggestive of adhesion, but the condition can not be said to present a definite symptomatology.

Rupture of the tumour, when cystic, may be induced by overdistention, papillomatous degeneration, infection, or violence. It frequently happens that, in cysts of the pseudomucinous variety, the secondary peripheral growths have very thin walls, and are, consequently, more liable to rupture from any of the preceding causes. The larger sacs, however, have been known to empty their entire contents into the peritoneal cavity. This is an accident which may or may not produce profound symptoms. If the rupture is slight, the sac small, and the fluid bland, the accident may be almost symptomless; whereas, if the rupture is extensive, the sac voluminous, and the fluid irritating or septic, the symptoms may be those of profound shock, followed by acute peritonitis and septicæmia. There is no means of determining in advance of exploration the exact character of the fluid of any ovarian

tumour. Pure pseudomucin is not irritating, nor is it septic, but if the tumour has become the seat of infection, however slight, this material serves as a convenient culture medium, and may thus become the source of contamination. When there are grounds for suspecting rupture of the sac, the indication is for immediate operation by abdominal section.

The **symptomatology of ovarian neoplasms** is sometimes very obscure. In certain forms of ovarian growth, notably in dermoids, there is pain from a very early period. In a majority of cases, however, there is nothing more than a vague sense of discomfort in the pelvis, due to the weight and tension exercised by the developing tumour. In many cases, there are no symptoms whatever to attract attention to the pelvis until the patient by accident discovers that she has an enlargement in either one or the other lower quadrant of the abdomen. There may or may not be disturbance of the menstruation, and, even in ovarian tumours of large development, the menstrual function seems to be but slightly modified. This modification of function may tend in the direction of either increase or diminution of the flow. In those cases in which the flow has increased, there will generally be found an antecedent history of pelvic disturbance—probably of an endometritis. In cases of amenorrhœa due to developing ovarian cystoma, the disappearance of menstruation, coincidently with abdominal distention, may lead to a suspicion of pregnancy. Cases of this kind are of frequent occurrence. While the tumour is yet relatively small, it occupies a position within the true pelvis, but as it grows larger it ascends into the abdominal cavity just as does a pregnant uterus. When the tumour is yet within the pelvis, its weight generally causes it to fall into the cul-de-sac of Douglas, usually either to one side or the other of the uterus. At this stage of its development, bimanual examination will enable the surgeon to outline the growth, and perhaps to determine from which side it develops. It is generally felt as a hard, or semi-fluctuating globular mass, its spherical outline being readily detected by palpation through the abdominal wall. To determine the side from which it develops and the location of its pedicle, Hegar advises drawing down the uterus with a tenaculum, employing the rectal touch or bimanual manipulation to outline the attachment. The mobility of the tumour depends upon the length and size of its pedicle, which is sometimes long enough to permit the growth to be carried far up to the pelvic brim, while in other cases it is so short that the tumour feels more like an abscess than a neoplasm. In some cases, the tumours are bilateral, a circumstance which may readily be confused with a multilocular or a multinodular growth. The uterus is very liable to be displaced to either one side or the other—or, as occasionally happens, the growth may be poised above and behind the womb, forcing the latter forward into a state of extreme anteversion. As the tumour grows larger, however, and descends into the abdominal cavity, its spherical outline becomes more and more apparent by

abdominal palpation. Irregular bosses or protuberances upon the surface of the growth indicate that it is multilocular. On percussion, the tumour will yield dulness over its entire area. One of the essential diagnostic signs relied upon by Dunlap, who was one of the very earliest of the world's ovariotomists, was the position of the intestines. As the tumour develops from one side or the other of the pelvis, the bowels are pushed upward and toward the opposite side. Abdominal resonance is restricted to the area occupied by the intestines. This position should be more or less constant. If a patient with fluctuating distention of the abdomen yields an area of dulness in the lower two quadrants of the abdomen, with a resonant note above, and if she manifests these signs both when sitting and lying, it may be safely assumed that she is either pregnant or is the victim of an ovarian tumour. If, however, upon lying down, the area of resonance descends toward the pubes, a suspicion of ascites, rather than of either of the foregoing, is justifiable. As the cyst increases in size and weight, it exercises increasing pressure upon the neighbouring viscera; this is the frequent cause of vesical irritation, constipation, and occasional profound disturbance of the kidneys. The urine, under such circumstances, becomes scanty, is loaded with albumin, and, if the pressure is long sustained, œdema of the extremity is the result. Hemorrhoids are another annoying result of pressure. Areas of pelvic tenderness are sometimes complained of when the tumour has attained considerable size. These are generally the results of either pressure or slight traumatisms, and depend upon the fact that the tumour, after attaining considerable size, may lose areas of protective epithelium and form adhesions to either the visceral or the parietal peritoneum.

The **diagnosis of ovarian neoplasms** is of importance, not only to establish their existence and whether they are ovarian in origin, but also to determine whether or not they are malignant. The effort to distinguish with accuracy between the different varieties of benign neoplasms is to be looked upon, from the practical standpoint, largely as a useless expenditure of energy and a waste of valuable time. It may be stated as a rule to which there are no exceptions, that ovarian growths, either by virtue of their primary characteristics, or in consequence of secondary changes, tend to the death of the patient. It follows from this fact that all ovarian growths should be subjected sooner or later to extirpation. The tendency to malignant degeneration, already noted, renders it important that even the so-called benign growths should be removed without unnecessary delay. This being true, it is not necessary to subject the patient to punchings, pommelings, and punctures, to establish the exact variety of the growth; for, after it has all been done, and the guessing is all over, precisely the same thing remains to be done. It is, however, frequently important for various reasons personal to the patient to indulge in delay; and it is, therefore, important to know with approximate accuracy, whether a given tumour is malignant or

benign. This fact, unfortunately, is not one that can be easily determined. It may be accepted as a rule, however, that the more rapid the growth, the more liable is it to be of a malignant character. The solid tumours are of the slowest growth, while proliferating cysts grow with more rapidity than any other of the benign neoplasms. When a growth which has been increasing at a certain rate manifests sudden acceleration in development, it should become an object of suspicion; the sudden increase may depend upon a change of type from benign to malignant, or, it may mean that the efferent circulation of the tumour has been interfered with, either by pressure of the growth itself, by torsion of the pedicle, or by other causes. The increase in the volume of a tumour due to sudden twisting of the pedicle is very sudden, and is associated with pain, followed in the course of a few days by toxæmic symptoms due to the absorption of necrotic products from the tumour itself. Increase of size due to a twisted pedicle may become spontaneously arrested, the tumour itself surviving by virtue of nutrition derived from extensive peripheral adhesions.

The diagnosis of *small ovarian tumours* is relatively difficult, although Davenport (*Boston Medical and Surgical Journal*) insists that they are usually accompanied by well-marked symptoms. He states, however, that pain, while usually present, does not bear any constant relation in its location, to either the situation or the variety of the tumour. Menstrual disturbances are the rule, the variation tending in the direction of excessive rather than of diminished flow. There seems to be a direct causal connection between severe uterine hemorrhages and cystic ovaries when the latter are closely adherent to the uterus. Uterine hemorrhage, associated with a pelvic tumour which is uninfluenced by intrauterine treatment, is more likely to be due to an ovarian tumour than to a fibroid. Reflex symptoms are comparatively rare, and, according to Davenport, occur chiefly in the later stages of the disease.

The diagnosis of even *large cystomata* of the ovary is not always easy. A number of the most distinguished operators have mistaken *pregnancy* for an ovarian cyst. It may be stated that there are but few distinguished operators in the world who have not at one time or another made an exploratory incision, with the result of finding a pregnant uterus instead of the suspected cyst. (See Pregnancy as a Complication of Ovarian Tumours.) In extenuation of this accident, it should be remembered that an ovarian tumour may occupy such a position as to interfere with the detection of pregnancy by either vaginal or bimanual manipulation, and it must be remembered, furthermore, that among the occasional erratic symptoms of ovarian cystoma, are reflex vomiting and mammary development, with enlargement, softening, and blue coloration, of the cervix. In view of these facts, occasional mistakes are to be expected. In the great majority of instances of pregnancy, however, the placental bruit may be heard, while, later, ballottement may be practised; and, after the period of quicken-

ing, the fœtal heart may generally be detected. It must be remembered, however, that even these signs may be obscured. This is particularly true of the placental bruit, which may be completely masked by the more pronounced bruit of the almost cavernous veins that develop in certain of these tumours. Ballottement may be defeated by the ascent of the uterus and the relatively low position of the tumour; while the fœtal heart may be situated so remotely that its pulsations can not be heard. Ascites is not infrequently mistaken for a unilocular ovarian cyst. This is particularly true in cases of encysted ascites, where the induced area of dulness remains inconstant, even when the patient assumes different positions. The ascites of tuberculous peritonitis frequently occurs in connection with tuberculous involvement of the mesenteries, or, at least, of the meso-enteron. The result of tuberculous infection in this locality is a contraction of the peritoneal fold, which prevents the intestines, even when laden with gas, from floating upon the surface of the ascitic fluid. In these cases, however, the morphology of the growth may be taken as a reasonably safe index of its character. A tumour fluctuating and spherical in the upright posture will maintain its outlines with but trifling variation when the patient lies down, whereas, if the distention depends upon free fluid in the peritoneal cavity, the abdomen will flatten to a certain degree, while there will be a corresponding distention of the ilio-costal interval. It rarely happens that a tumour so develops as to distend the abdominal wall between the crest of the ilium and the ribs.

Large cysts of the mesentery and *nephrydrosis* have been mistaken for ovarian cysts. To distinguish between an ovarian cyst and nephrydrosis it is important to remember that, in the former, the tumour develops from below upward, and in the latter from above downward. In the former, the upper, and in the latter, the lower margin of the growth is free. This sign is, of course, absent when the cyst is large enough to fill the abdominal cavity. If the tumour is of congenital origin, the presumption of nephrydrosis is strengthened, although Alban Doran has reported a case of congenital ovarian tumour. The position of the colon relatively to the cysts is important in distinguishing between these two conditions. In many cases, the bowel can not be palpated or percussed; under which circumstances Simon introduced an effervescing enema to distend the bowel. Exploratory puncture has been practised as a diagnostic means in cases of suspected nephrydrosis, but it is not to be recommended, not only for the reasons already enumerated, but because, according to Pozzi, the fluid from nephrydrosis is no more characteristic than is that from the proliferating serous cyst of the ovary or of the parovarium. Urea and uric acid may be absent from nephrydrosis and present in an ovarian cyst, a circumstance which will only tend to increase the pre-existing confusion. Urethral catheterization, as practised by Pawlick and Kelly, may be of value in distinguishing between these two frequently confusing conditions.

Echinococcous cysts of the peritoneal cavity may be mistaken for

ovarian tumours. They acquire great volume and give rise to corresponding distention of the abdominal walls. They may displace viscera, encroach upon the diaphragm, and occasion interference with the action of the heart and lungs, just as occurs in cases of advanced or neglected ovarian tumours. The facts, however, that the growth started in one of the upper quadrants of the abdomen, generally the right, extending thence toward the pelvis, and that the growth is more rapid than is ordinarily the case in pelvic tumours, will place the practitioner upon his guard. The fluctuation in hydatids is remote and circumscribed. The hydatid fremitus is considered characteristic and decisive. It is presumed that, in the majority of these cases, the origin of the parasitic infection is in the liver, and that the contamination of the peritoneum is consecutive to rupture of a lymphatic cyst and the consequent escape of the echinococci into the peritoneal cavity. When once implanted in the peritoneum, however, these parasites may go on multiplying in any one cavity. They may undergo retrogressive changes and may, themselves, become the seat of bacterial infection. Sir Spencer Wells has recorded a case in which the degeneration of the hydatid cysts was associated with the formation of gas, due, in all probability, to the action of the *Bacillus aerogenes capsulatus.*

Large malignant neoplasms of the lymphatics may occasion confusion in making a diagnosis of a seeming ovarian tumour. These growths may originate from the lymphatic glands within the broad ligament, or beneath the pelvic peritoneum, or even higher up. Dr. Mary Almira Smith, of Boston, has reported an interesting case in which a large malignant growth had developed from a lumbar lymphatic gland. It was the size of a child's head and presented all the physical characteristics of an ovarian tumour.

Phantom tumour yields a resonant note on percussion and entirely disappears under anæsthesia.

A *distended bladder* has been mistaken by very capable physicians for an ovarian cyst. When the fluctuating tumour occupies a median position and extends to the symphysis pubis, and when it can not be moved from this position, a catheter should always be inserted as a precautionary measure. The indication for catheterization is positive when the patient complains of slight incontinence.

Fibrocystoma of the uterus may present many physical signs in common with an ovarian tumour. Rishmiller, in this connection, calls attention to the fact that fibrocystoma of the uterus is relatively infrequent and occurs usually in women over thirty years of age. Its growth is slow at first, but rapid after attaining a certain size. Menorrhagia is seldom present. In fibrocystoma we have a lobulated condition which can be felt through the abdominal parietes, umbilicus not prominent, uterus moving with the tumour and the uterine cavity generally elongated; while, in ovarian cyst, we have no lobulation except in polycysts, the umbilicus is prominent, the uterus moves independently of the tumour and its cavity is not elongated. The de-

tection of hard nodules would be significant, but hard and tense cysts may impart the same sensation. Fluctuation is very hard to detect for the reason that the tumour gives rather an elastic feel.

These confusing conditions occurring with relative frequency in the hands of the most distinguished and experienced operators, became so apparent to Lawson Tait that he proclaimed, not only the expediency, but the importance of *exploratory incision* as a diagnostitial measure. This decree has been ratified by the universal acquiescence of the medical profession. The presence of an abdominal tumour of undetermined character and showing a constant tendency to increase in size, is of itself, not only a justification, but an imperative indication for an exploratory abdominal section. The time has long since passed when surgeons felt justified in pronouncing an unequivocal diagnosis of the exact character of intra-abdominal growth upon evidence furnished by external examination alone.

Puncture of the cyst through the abdominal wall, or through the vagina, is never a justifiable diagnostitial measure. The fact that puncture is sometimes practised without incident, does not in the least demonstrate that the operation is without danger, or that the operator is without responsibility. The possibility of wounding important blood vessels, the location and development of which under these circumstances is always anomalous; the possibility of puncturing a loop of intestine; the probability of inducing a possibly septic seepage into the peritoneum; and the certainty of inducing adhesions, are all cogent reasons against a manœuvre which, under the most favourable circumstances, can only be looked upon as groping in the dark. The demonstrated utility and innocuousness of exploratory incision, undertaken with reference to the completion of the operation should it be found justifiable, renders preliminary puncture of the cyst neither necessary nor defensible. It is a matter of scientific interest, however, to know that a clear and noncoagulable fluid from an abdominal cyst probably indicates the parovarian origin of the latter, although proliferating serous cysts of true ovarian origin may yield a fluid of similar reaction; whereas, the demonstrated presence of pseudomucin (see Test for Pseudomucin) indicates that the cyst is of true ovarian origin.

If it were true, which it is not, that the fluid obtained by tapping would enable the surgeon always to recognise the exact character of the cyst the manœuvre would still be without practical value, because precisely the same treatment, namely ovariotomy, would be indicated, whether the fluid yielded pseudomucin or not.

The **treatment of neoplasms of the ovaries** is necessarily surgical. All attempts to cure these growths or to arrest their progress and development by medicines, manipulations, or electricity, have proved, not only futile, but in many instances directly damaging to the patient. It should be accepted as a rule, that all cases of ovarian tumours should be operated upon as soon after the diagnosis has

been made as the conditions will judiciously permit. Delay may be indulged in temporarily, to improve the general condition of the patient and to place her in a better condition for operation. But it should never be prolonged beyond the time necessary to put her in the best condition for ovariotomy.

Ovariotomy.—*History.*—Ovariotomy was first performed by Dr. Ephraim McDowell, who lived in the town of Danville, in what was then known as the backwoods of Kentucky. He had been a student in Edinburgh of John Bell, who had suggested in his lectures both the possibility and the advisability of removing ovarian tumours, though he himself had never operated for this purpose.

The seed sown in the mind of young McDowell brought forth its first fruit in 1809, when he removed a large ovarian tumour from Mrs. Marion Crawford, who not only recovered from the operation, but lived thirty-eight years afterward. Although McDowell did not publish the report of this case and of two other similar operations until 1816, his claim to be the first ovariotomist in the world is now everywhere admitted without dispute. McDowell performed, altogether, 13 ovariotomies, with 6 deaths.

The principal operators in America to follow in the footsteps of McDowell within the next twenty-five years, were Dunlap, of Ohio, Nathan Smith, of Connecticut, Peaslee, of New York, and the Atlees of Pennsylvania. Lizars operated in Edinburgh in 1824 and 1825, but with such poor success that the operation did not gain much headway in Great Britain until 1842, when Charles Clay, of Manchester, scored a success greater than any operator up to that date. Baker Brown, between 1852 and 1856, performed 9 ovariotomies with 7 deaths. He operated no more for four years, when he began a most successful career which was suddenly cut off by his untimely death. In 1858, Spencer Wells, of London, commenced his remarkable record, which, at the time of his death, had gone well up toward 2,000 cases. He reduced the mortality of this operation to 25 per cent but never got much below that figure. In 1862 Thomas Keith, of Edinburgh, performed his first operation and soon became the most successful living ovariotomist. Lawson Tait, of Birmingham, in the course of his extraordinary and startling career reported a series of 139 ovariotomies without a death. Bantock and Thornton, of London, following in the footsteps of Spencer Wells, in the Samaritan Free Hospital of that city, greatly improved upon the teachings of their master, and reported long series of ovariotomies with much smaller mortality than Wells had ever been able to secure. In France the operation did not make equally rapid headway until Péan and his followers began to do very successful work. On the Continent, Koeberlé, Schröder, Billroth, Martin, Leopold, Sänger, and many others, began and carried on the good work, until now, in all parts of the world, ovariotomy is one of the most successful of modern surgical operations. Thousands of women have had their lives saved, and have lived

long years of usefulness and happiness as a final result of McDowell's glorious effort in 1809.

Indications.—Ovarian tumours should be removed as soon as preparation can be conveniently made after their diagnosis. There is no wisdom whatever in delay. Nothing can be gained and everything may be lost by putting off the operation. No medicine, or outward application or treatment of any kind whatsoever, is likely to cure an ovarian tumour. As ovariotomy is the only source of relief, the sooner it is resorted to the better. The life of a woman with an ovarian tumour, as a rule, is not greater than three years from the time of its discovery. She is likely never to be in a better condition for the operation than at the time of diagnosis. The chief indication then for ovariotomy is a clear and unmistakable diagnosis.

Technique.—While a full description of the technique of ovariotomy would require a statement in regard to the preparation of the patient, of the operating room, of the surgeon, his assistants and nurses, the instruments, sponges and dressings, etc., the limited space allotted to this chapter will not permit of these otherwise necessary details, especially as the general subject of operative technique is fully described in another part of this work. Readers are referred, therefore, to the chapter on general technique for a description of the arrangement of the sterilized instruments and towels, and of the nurses with their sponges and their basins of hot and cold water, their sterilized solutions, etc., while we proceed at once with a description of the technique of the "operation itself," which, for the sake of convenience and brevity, may be described under the following heads:

1. Instruments required.
2. The anæsthetic and the anæsthetizer.
3. The incision of the abdominal wall.
4. Tapping and removing the contents of the cyst.
5. The treatment of adhesions and the ligation of the pedicle.
6. The toilet of the peritoneum.
7. Irrigation and drainage.
8. Accidents and complications.
9. Closure of the wound.
10. Dressings.
11. After-treatment.

Fig. 274.—Dissecting forceps (page 640).

Instruments.—The instruments necessary for an uncomplicated ovariotomy might readily be carried in the surgeon's overcoat pocket, but as we so often come upon the unexpected in the abdominal cavity, an experienced ovariotomist will have sterilized at the same time everything which he might require in case he should meet with complications and conditions which he had not suspected when he made his diagnosis.

The instruments most frequently required are: one or two sharp scalpels; a dozen hemostatic forceps; half a dozen prepared sponges or gauze pads; three pairs of scissors, one long and straight, one curved on the flat and blunt pointed, and one short, thick, strong, and curved

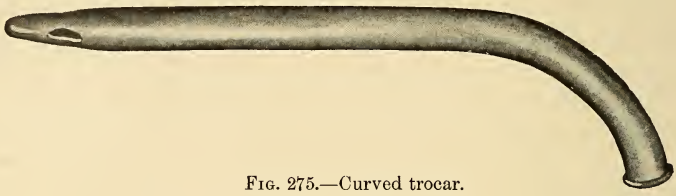

Fig. 275.—Curved trocar.

at right angles; two dissecting forceps (Fig. 274) for picking up the peritoneum; Tait's or Spencer Wells's trocar with long rubber tubing attached, to conduct the fluid into a bucket under the table (Fig. 275); two large cyst forceps, to grasp and withdraw the empty sac; two long aneurism needles, threaded at the point, for transfixing and ligating the pedicle; a good, free-working irrigation apparatus; needles long, straight, and curved, to close the abdominal incision; an assortment of sterilized silk, silkworm gut, and catgut; long perforated glass tubes and sterilized gauze, to be used, if necessary, in drainage.

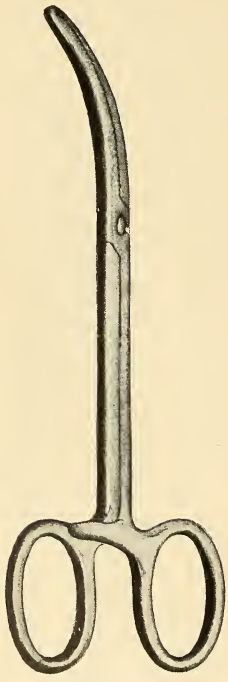

Fig. 276.—Pressure forceps.

The following, also, *may* be needed: An assortment of large and small pressure forceps (Fig. 276), a catheter, retractors, rubber cord or tubing, fine curved and straight needles, a portable electric light, an electro-cautery, and Monsel's solution. All these instruments, sutures, etc., should be carefully assorted and placed in appropriate trays upon a table near by, and covered with sterilized hot water by the assistant who is to hand them to the operator as needed, during the various stages of the operation. A basin of hot water should be placed upon a small table near the surgeon in which he can immediately cleanse his hands should they become soiled with pus or fluid from the tumour. This water will need to be frequently changed as the operation proceeds.

While these and all other preparations by the surgeon are going on, his assistants, and nurses, to insure an aseptic environment and operation, the patient, who has also been properly prepared, may be anæsthetized in an adjoining room, thus preventing the fright and shock of being brought into the operating room and

placed upon the table in plain sight of the instruments, the operator, and his assistants, in their operating costumes.

The Anæsthetic and the Anæsthetizer.—(See Anæsthesia.)

The Abdominal Incision.—Although specially described elsewhere in this work, it may be well to say here that it need not be longer than 3 inches at first, and should be carefully and deliberately made. Reckless opening of the abdominal cavity with one stroke of the knife is as unwise as it is dangerous. Large unilocular ovarian tumours have been frequently removed by Joseph Taber Johnson and others through a 3-inch incision. Should occasion require, the opening can be easily enlarged with the scissors, when necessary, to deal with adhesions or to deliver partly solid tumours without bruising the tissues.

While advocating the short incision, one as long as is necessary is always made as we proceed. It is not needful to spend valuable time in searching for the linea alba. Many surgeons think that a stronger cicatrix is secured by the union of the cut muscles.

Before opening the peritoneum, all bleeding should be arrested. That membrane may now be caught up between two forceps and nicked with a knife or scissors. In order to avoid the possibility of injuring the intestines, it is safer to roll the peritoneum between the thumb and finger before opening it. The intestines, if not adherent, will immediately drop back out of harm's way as soon as air rushes in through the opening. The incision is now enlarged with the scissors upon the index finger, which acts at the same time as a guide and a protection to the intestines against injury (Fig. 35, p. 108). All bleeding having been arrested, two fingers of the left hand should be passed over the face of the tumour in all directions to ascertain the nature and extent of adhesions.

The Emptying of the Cyst.—The pearly-gray cyst wall can be readily seen through the gaping edges of the wound, and a large-sized Tait or Wells trocar can be passed into the tumour at the upper angle of the wound and the fluid drawn off through a tube at the end of the trocar, which conducts it into a sanitary bucket underneath the table. The relapsing walls of the emptying cyst, unless prevented by adhesions, may now be drawn out of the wound with the fingers, or with large cyst forceps. The assistant should press together the abdominal walls, which will aid in the expulsion of the cyst contents and at the same time prevent the escape of intestines, the soiling of the edges of the abdominal wound by the fluid contents of the cyst, or their entering the abdominal cavity. If it should be a multilocular cyst, its various compartments may be emptied by passing the trocar in different directions. If this does not succeed in reducing the size of the tumour sufficiently, the hand may be passed into an enlarged opening and these various compartments ruptured with the fingers. The hand, upon withdrawal, may bring the collapsed tumour sac along with it. It is wise to keep the opening in the cyst wall always outside the abdom-

inal cavity in order to prevent the soiling and infection of the peritoneum by any colloid, dermoid, or other infecting material which it would be exceedingly difficult to wash out.

Adhesions of the Cyst and Ligation of the Pedicle.—Any adhesions which may exist will come into view as the empty sac is withdrawn. Those which are recent and the result of inflammation can be easily pressed off with a sponge, or separated with the fingers. Older and firmer adhesions, which are likely to contain blood vessels, should be ligated in two places with fine silk or catgut, and cut between the ligatures with the scissors.

Adhesions of the omentum are generally vascular, and bleeding surfaces which are not controlled by exposure to the air or sponge pressure, may require ligation. When the cyst wall is adherent to the intestine, or can not be readily peeled off, a portion of it may be left attached, rather than to run the risk of laceration by its forced separation. Should an opening be made in the intestine, it should be immediately closed with fine silk. There are fewer incomplete operations now than formerly. It is generally estimated that the mortality is greater where circumstances seem to require that the operation be left uncompleted, than where we are able to make a thorough removal of the tumour and toilet of the peritoneum, even in our worst cases.

The ancient custom of Sir Spencer Wells, and many other distinguished ovariotomists, in their day, of clamping the ovarian pedicle upon the outside of the abdomen is no longer practised. Clamps have been superseded by the ligature, the cautery, or the angeiotribe, according to the preference of the operator. (See Hemostasis.) In each case, the constricted or seared stump is dropped back into the peritoneal cavity, and, in all cases where drainage is not required, the abdominal wound is completely closed. While an assistant holds up the empty sac or delivered tumour, the operator transfixes the pedicle as near as possible to the uterus with a long-handled, dull-pointed needle, threaded at the point with pure Chinese silk or catgut, according to his preference, and thus securely constricts the vessels and tissues in the pedicle. When doubt exists as to perfectly safe constriction, the ligature is brought around the entire mass and securely tied again, thus shutting off any possibility of subsequent hemorrhage. A figure-of-eight or a Staffordshire knot, when properly applied is equally safe. Taber Johnson still retains his preference for pure Chinese silk ligatures for the pedicle. They very rarely become infected or make any trouble. Many more accidents have resulted from the relaxing, untying, or slipping off, of catgut ligatures, and from sepsis caused by imperfectly prepared catgut, than from silk. Some surgeons, however, are very enthusiastic in regard to the use of catgut when sterilized in solutions of cumol or formalin. Recently, Skene, of Brooklyn, has recommended an electro-cauterization of the pedicle instead of ligatures, and still more recently the angeiotribe

has been recommended as a safe and proper substitute for all other means of treating the pedicle. If we meet with a pedicle especially broad and thick, it may require ligation in several places, making what is called a chain ligature.

In cutting off a tumour above the point of constriction, a button of tissue should be left, sufficiently large to prevent the possibility of the slipping off of whatever ligature is used.

Minor, of New York, has described a variety of tumour in the broad ligament, which has no pedicle whatever, and has taught us how to enucleate it with safety from the tissue in which it lies embedded, ligating separately any bleeding vessels which are discovered.

After the removal of an ovarian tumour, the other ovary should be examined also; if found healthy, it should be let alone. If the ovary is found somewhat diseased, every "conservative" effort should be made to preserve whatever portion of it can be properly left to perform its usual function. The subsequent condition of the patient will be much more nearly normal if sufficient ovarian tissue is preserved to keep up the menstrual molimen, and thus to prevent a premature occurrence of the change of life, with all that that implies.

The Toilet of the Peritoneum.—In those cases in which a simple ovarian tumour has been removed without rupture or spilling its contents into the abdominal cavity, very little in the way of a "toilet" is required; the less manipulation of the intestines and exposure of the abdominal contents the better. Even the small sponge, held in the grasp of a long-handled forceps, which is usually passed down into the pelvic cavity in search of blood or other fluids, may frequently be omitted, and the omentum carefully drawn down over the intestines and the wound closed. In those cases where the omentum has been lacerated or torn in separating adhesions, if there is any evidence of bleeding, it should be carefully drawn out of the wound, spread over hot sterilized towels, and the bleeding points sought out and ligated. In most cases, simple oozing can be arrested by hot water or hot sponge pressure. If some portion of the omentum is considerably lacerated, a ligature may be applied behind the leaking surfaces and the omentum tissue boldly cut away. In those cases where there has been much hemorrhage from tissues lacerated by the separation of adhesions, or the abdominal cavity has been soiled and possibly infected by fluids from malignant tumours, or by pus from infected abscesses, the cavity should be thoroughly irrigated with hot normal salt solution. In that class of cases which have heretofore required transfusion, large quantities of the normal salt solution may be poured into the abdominal cavity and left there to float the intestines, to prevent the immediate occurrence of adhesions, and to perform the office of transfusion by being absorbed into the circulation. The great thirst which usually follows ovariotomy, as well as all other abdominal operations, is much alleviated by the salt solution. No germicide of sufficient strength to be of any service in destroying

germs is ever permissible inside the abdominal cavity. If it were sufficiently powerful to kill the germs, it would at the same time kill the patient.

General irrigation of the abdominal cavity is not employed at the present day as frequently as it was formerly. A localized collection of infectious fluid, readily absorbed by a sponge, might be carried to remote parts of the cavity by general irrigation and set up an incurable septic peritonitis. The abdominal wound may be closed by what have been described as through-and-through sutures, or the tissues may be brought together by from three to six tiers of sutures according to the preference of the operator. When the through-and-through sutures are used, four to the inch should be employed. The object of the more thorough suturing is the more sure prevention of ventral hernia. Taber Johnson doubts whether half a dozen layers of sutures accomplish this purpose more thoroughly than well-applied through-and-through sutures. From the investigations which he has been able to make, about the same number of cases of ventral hernia occur with one method as with another. As ventral hernia will be prevented by perfect union of the fascia, after the application of the through-and-through sutures Taber Johnson is in the habit of inserting one silkworm gut to the inch through the edges of the fascia, and thus securing permanent approximation of its edges when tied. If union fails to occur, these nonabsorbable, buried sutures will hold it together forever. Some operators prefer silver wire for this purpose.

If a fixed rule, always to close the abdominal wound with five or six layers of sutures, is adopted, the operator will not infrequently find himself spending more time over the closing of the abdominal wound than over all the other steps of the operation together.

Drainage.—The present practice of ovariotomists is, so far as possible, to avoid drainage. Not a few gynecological surgeons have recently reported that they have not drained the abdomen after ovariotomy for a number of years, even in their worst cases, and that they find no increase in their mortality. In those cases where drainage is considered absolutely necessary on account of the soiling of the peritoneum with infectious fluid, gauze drainage is used much more frequently than the glass tubes. Neither the glass tube, nor gauze drainage, is likely to be of much service after twenty-four hours; for the glass tube does not drain any greater area than the little pocket at its distal extremity, on account of its being shut off from the abdominal cavity by lymph which has been poured out around it; while gauze, after it has once become wet, ceases to absorb more fluid, and only drains by lying in contact with dry gauze which may absorb from it.

Dressings.—The dressings applied to an ovarian wound need hardly differ from those applied after any up-to-date aseptic operation. The practice of dusting iodoform powder over the edges of the wound has been abandoned. The wound should be thoroughly dried and

cleansed, and pads of gauze placed on each side of the row of sutures, and another, thicker gauze pad laid over them both. A combined dressing is then applied over the abdomen from hip to hip and secured by broad strips of adhesive plaster. A thin flannel or many-tailed bandage may now be applied, securely holding the dressings permanently in position. These do not require to be changed for seven days, if all goes well. If the tumour has been very large and the abdominal walls have sunk in considerably, the depressed spaces should be filled out by sterilized absorbent cotton.

After-treatment.—The after-treatment of a simple case of ovariotomy amounts to little more than keeping the patient clean and letting her alone. Give her a cheerful nurse, protect her from visitors, and encourage her to get well. Little medicine is required beyond what is necessary to move the bowels, quiet restlessness, and produce sleep. As soon as the patient has had a good operation from the bowels she is considered convalescent. This is usually produced by small doses of calomel, followed by teaspoonful doses of Rochelle salts every two hours until the bowels move. It was formerly the custom to withhold all food or drink for twenty-four hours. The piteous appeals of the patient for water to quench her thirst were stubbornly resisted, but we find by increasing experience that patients may, without injury and greatly to their comfort and happiness, take frequent sips of hot water or tea a few hours after their recovery from the anæsthetic, unless tormented by the ether nausea. Patients, it is found, may also take with benefit small draughts of beef essences or concentrated forms of liquid nourishment after the first twelve hours. If this disagrees with them, it should be withheld for a while. It is best to adhere to the rule that patients should not see visitors for a week after their operation. Exceptions will occur where a discreet mother or husband may see the patient a few days after her operation with great benefit. The patient should be urged to pass her water in a bedpan. The use of the catheter in the hands of the most skilful nurse has often produced urethral or vesical irritation. Its routine use for several days after all ovariotomies should be abandoned.

The use of opium should be avoided when possible, as the patient's pain, nervousness, and restlessness, are generally increased and prolonged by the unwise use of this drug. There will occur, now and then, a case where a hypodermic of morphine or codeine will quiet restlessness and produce the greatest amount of comfort, with no harm whatever following its use; but the routine employment of opiates after ovariotomy is full of mischief and trouble.

If the bowels are painfully distended by collections of gas, the introduction of a rectal tube gives much relief. If, upon removal of the dressing on the seventh day, the wound is found well united, the sutures may be all gently removed. If union is not perfect, or if stitch-hole abscesses have occurred, a few of the stitches can be left

for two or three days longer. If the wound is perfectly dry, no treatment is necessary, but narrow strips of rubber plaster may be placed across the wound to hold it securely while a firmer union is taking place. The gauze dressings should be changed and held in position by a firm clean binder.

It is better for the patient to remain in bed three weeks. Young, vigorous patients, who have had an uninterrupted recovery, have gone home from the hospital at the end of two weeks without harm, but this is not a safe practice. If no pus is present, the wound may not require dressing oftener than once a week. At the end of the fourth week, the patient may safely be allowed to return to her home, but should be provided with an abdominal bandage, which she should be advised to wear for six months or a year, and to abstain, so far as possible, from overwork, lifting heavy weights, or any straining occupation which might have a tendency to produce ventral hernia.

Accidents.—Accidents may occur during ovariotomy from the administration of the anæsthetic, or from the stripping off of the peritoneum from the abdominal walls or the intestines. The cyst wall may be accidentally ruptured while separating adhesions. Bleeding points may be overlooked, and the patient's life lost from hemorrhage after the closure of the incision. Ligatures have slipped off the pedicle, catgut has become untied; intestines, omentum, or bladder, have been injured when opening the abdominal cavity, or torn while separating adhesions. None of these accidents should occur in the hands of the average conscientious operator. Sponges, forceps, scissors, rings, and eyeglasses, have all been lost in the abdominal cavity during an operation, and have been searched for subsequently or found during a post-mortem.

Obstruction of the bowels may be caused by paralysis of, or kinks or twists in, the intestines. Fistulæ may follow the use of infected ligatures, and ventral hernia may occur to torment the patient in some cases to such an extent, that her sufferings are greater after her operation than they were from the condition which made the operation necessary.

Mortality.—The average mortality at the hands of all operators the world over, is probably about 10 per cent. Experts in the principal cities of the world will often report a series of 100 cases, however, with no mortality whatever. Leaving out the cases of malignancy and the unexpected accidents, the mortality of ovariotomy in the hands of experienced operators will probably not range above 3 or 5 per cent, while during the first half of the present century the mortality lingered very closely around 50 per cent. We are proud and happy to state that as the new century is dawning the mortality is reduced to less than 5 per cent.

Incomplete Ovariotomy.—This is sometimes made necessary by the character of the growth, and by the extent and density of its adhesions. Proliferating cysts, the pedicles of which have been subjected

to even temporary torsion, exposed to traumatism or infection, or have become the seat of secondary malignant changes, may become so intimately involved with the intestines that they can not be removed without irreparable, if not fatal, injury to the latter. Under such circumstances, it may be found expedient to remove a part of the cyst wall, stitching the remainder to the margins of the intestinal incision, an operation which Pozzi designates as the marsupialization of the patient. It is always a matter of great importance to determine when this step should be taken. As a rule exemplified in the reported cases of Vander Veer (*New York Medical Journal*, 1893), it should be done in the presence of the foregoing complications, particularly when the operation has already been so long or so difficult that, if still further prolonged, the patient will die from hemorrhage or shock. In fixing the edges of the sac to the edges of the abdominal wound, it is important to see that all bleeding points in the former are brought under control. This can be accomplished, as a rule, by means of ligatures; but in exceptional cases, the cyst walls will be found to be of such an embryonic character that they will not sustain a ligature, when it will become necessary to resort to the cautery, to styptics, or to sponge packing, to control the bleeding. Cases have been reported in which the remnant of tumour tissue has sloughed away through the opening left by this operation, the patient making an eventual recovery. Fortunately, complications rendering this course necessary are now of relatively rare occurrence.

Ovariotomy during Pregnancy.—This is frequently an operation of expediency. The mortality from this operation, if done during the first five or six months of pregnancy, is not higher than when done in a nonpregnant state. Olshausen has performed the operation 26 times without a single death. The danger to both mother and child increases with the progress of gestation. The results are most favourable for the mother in the second, third, and fourth months, and for the child in the third and fourth months—although favourable results are obtained even in the last month of gestation. The liability to rupture renders ovariotomy the desirable alternative at any stage of pregnancy. "Palliative" treatment by puncture of the cyst does not palliate; on the contrary the cyst rapidly refills, with an increased tendency to adhesion and rupture.

Successful cases of double ovariotomy during pregnancy have been reported by Vander Veer, Knowsley Thornton, Gardner, Montgomery, Mundé, Potter, Bovée and others. Potter's case, reported to the American Association of Obstetricians and Gynecologists (*vide Transactions*, 1888), was probably the first case in America in which a woman went to full term after a double ovariotomy done during the course of gestation. In this case, Potter operated in the latter part of the fourth month; there was a tendency to rhythmic uterine contractions on the seventh day, but these speedily subsided, after which she went to full term without incident. These cases must be accepted

as establishing the safety of the operation—although the liability of a double ovariotomy to induce abortion must be considered as greater than that which pertains to the operation upon one side only.

The results of ovariotomy during pregnancy are favourable. Dsirne reports 135 cases with 8 deaths, being a mortality of 5.9 per cent. Subsequent reports from individual operators do not tend to increase the mortality. The influence of ovariotomy, under these circumstances, upon pregnancy, has been ascertained with approximate accuracy. Olshausen found pregnancy interrupted in about 20 per cent of his cases. While Dsirne (*Archiv für Gynäkologie*) found that it was interrupted in 22 per cent of 114 cases which he collected. This seemed to vary somewhat according to the stage of gestation, as indicated by the following table by Dsirne:

At Months.	No. cases.	Interruptions of pregnancy.	Percentage.
2	11	5	45.5
3	28	4	14.3
4	21	2	9.5
5	10	4	40.0
6	11	4	36.4
7	5	3	60.0
8	5	2	40.0
9	1	1	100.0

Bovée (*American Journal of Obstetrics*) has tabulated 23 cases in which extirpation of the uterine appendages has been practised in the presence of pregnancy. Ten of the cases were for ovarian cyst, while in 8 out of the 10, the cysts were double; all the patients recovered.

CHAPTER XLII

ECTOPIC PREGNANCY

Historical résumé—Definition—Etiology—Classification—Course and termination—Histology—Symptomatology—Diagnosis—Treatment.

Historical Résumé.—The term ectopic pregnacy, from ἔκτοπος (ἐκ, out of, and τόπος, a place), was suggested by Dr. Robert Barnes in lieu of the familiar term extrauterine pregnancy, to designate a malposition of the fertilized ovum. It has been very generally accepted into gynecological nomenclature as more accurately designating the pathology of this most interesting condition. Since the fertilized ovum may be arrested and may develop in that portion of the tube passing through the uterine walls, it is apparent that such a pregnancy *would not* be extrauterine but *would* be ectopic.

This pathologic condition until recently constituted a dark chapter in gynecological surgery. It was altogether misunderstood in its etiology and pathology, its symptoms were misinterpreted, and hundreds of deaths occurred annually which would now be prevented by timely surgical intervention. Following the possibilities of aseptic surgery, this great achievement was accomplished by one man, Lawson Tait, whose genius illumined the entire subject and established methods of cure that approach perfection. The first correct interpretation of the pathology of this abnormity, which has such heavy mortality, was attained by Bernutz and Goupil, two able French observers who have made an exhaustive study of the disease by post-mortem examination. The work of these eminent students of pathology was translated into English in 1866 and widely circulated under the auspices of the New Sydenham Society by Alfred Meadows. The work was ably reviewed in America at great length by Parvin, yet no surgeon adopted the true pathology of extrauterine pregnancy as therein set forth. John S. Parry, of Philadelphia, made a valuable contribution to the subject in a book published in 1876, but did not elucidate the pathology or recognise the surgical aspects involved when, through the advance of aseptic surgery, it became practicable to open the abdomen with safety for the relief of grave and obscure intra-abdominal disease. Tait dealt with the subject in a masterly way. Utilizing the post-mortem researches of Bernutz and Goupil and the clinical observations of Parry, he elucidated the entire subject, classified its various types and phases, and formulated and demonstrated with the mind

of a genius and the hand of a master, therapeutic resources which have placed his name forever among the benefactors of science and humanity.

Definition.—The term ectopic, or extrauterine, pregnancy is, as already stated, applied to a malposition and abnormal development of the fertilized ovum. After fertilization the ovum may establish its habitat within the ovary (ovarian pregnancy), within any part of the free Fallopian tube (tubal pregnancy), or within that portion of the tube which passes through the uterine wall at the cornu (interstitial pregnancy). Primarily, ectopic pregnancy is almost invariably situated in the Fallopian tube, and ovarian pregnancy is so very rare that its existence has been denied both by pathologists and surgeons. However, specimens have been studied carefully by competent observers, which establish the fact that this anomaly actually does occur; but the instances are so few as to render ovarian pregnancy an extreme rarity in clinical experience. Ectopic pregnancy, as a rule, is tubal.

Etiology.—In considering the etiology of ectopic, or, preferably, tubal pregnancy, it is necessary to review to some extent the physiology of the Fallopian tube and the impregnation of the ovum. The tubes are the ducts through which the ovum, when discharged from the ovary, travels into the uterine cavity; hence their name, oviducts. From observations and experiments made on the lower animals, it appears probable that the transport of the ovum is effected mainly, if not exclusively, through the action of the ciliated columnar epithelium lining the tubal mucous membrane. It is quite probable that peristaltic movements of the tubes, if they take any part at all in the transport of the ovum, play a minor rôle only. We have every reason to believe that in the human being, as is the case in some of the lower animals, judging from observations actually made, the fertilization of the ovum by the spermatozoa occurs in the outer half or outer third of the tube. Normally, an ovum fertilized in the tube will, in a few days, travel into the uterine cavity, and will there become implanted for further development. The question arises, What cause or causes are responsible for an impregnated ovum remaining and becoming implanted in the tube, instead of passing into the uterus? Certain alleged causes, formerly frequently cited as responsible for tubal pregnancy, such as inflammatory diseases of the uterus and tubes, must be absolutely discarded. We know now that these very conditions, instead of being the cause of tubal pregnancy, make a woman sterile for the time being, and therefore exclude tubal, as well as normal uterine pregnancy. It is impossible here to go into a discussion of all the alleged causes of tubal pregnancy, since most of them really deserve detailed consideration. Herzog, who has carefully studied the gross and fine anatomy of over 30 cases of tubal pregnancy, believes that, in a considerable proportion, congenital anomalies of the tubes must be held responsible for the establishment of an ectopic gestation. Herzog has

certainly twice, and possibly three times, seen tubal pregnancy in a diverticulum of the main canal (Fig. 277), and once in an accessory blind fimbriated extremity. (Henrotin and Herzog. Anomalies du Canal de Müller, comme cause de grossesse ectopique. *Revue de chirurgie abdominale,* 1898.—Henrotin and Herzog. Very Early Rupture in an Ectopic Pregnancy in a Diverticulum. *New York Medical Journal,* 1899.) Several times he noticed that the tubal canal in

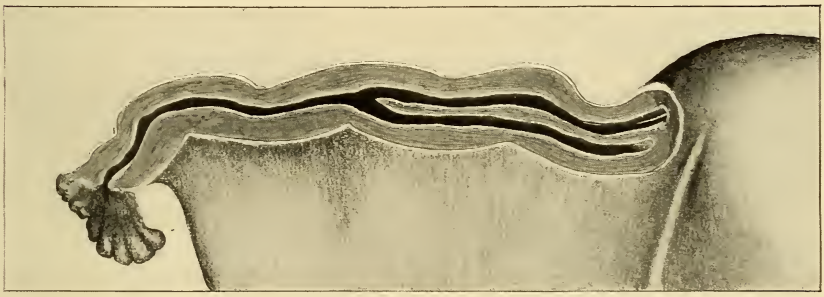

Fig. 277.—"A diverticulum of the main canal."—Herzog.

which the pregnancy occurred was unusually tortuous, so that the road from the fimbriated extremity to the ostium internum of the tube, which the ovum would have to traverse, was an unusually long one. The theory that congenital anomalies are the cause of tubal pregnancy is supported by facts.

Another cause assumed by Herzog can not yet be supported by direct, actual observations. He is of the opinion that the tubal mucosa takes part to a certain extent in menstruation. Normally, the menstrual changes of the tubal mucosa are insignificant, compared with those of the uterine mucosa. Occasionally, however, the tubal mucous membrane shows intense menstrual changes, which may be so pronounced as to lead to the formation of a hematosalpinx. We can hardly doubt that the menstrual changes of the uterine mucosa prepare the latter for the reception of an impregnated ovum, which, as appears most probable from the latest contributions upon the subject, eats or corrodes its way into the substance of the uterine mucosa by the aid of a phagocytic trophoblast (see page 657). Whenever the tubal mucous membrane undergoes extensive menstrual changes, it must become a soil into which an impregnated ovum can easily implant itself. It therefore appears very probable to Herzog that such well-marked menstrual changes in the tubal mucosa frequently become the cause of an ectopic implantation of a fertilized ovum.

So far as our exact knowledge goes to-day, we must, however, confess that we are unable in most cases of ectopic gestation definitely to give the exact causes of this occurrence, often so very grave in its consequences. That our knowledge as to the etiology of most cases of ectopic gestation is yet so very deficient, lies in the very circum-

stances surrounding this occurrence. In addition, we must not forget that when we obtain a specimen for examination post operationem or post mortem, hemorrhages and secondary changes have often so mutilated the parts that exact anatomical studies frequently become utterly impossible.

Classification.—The varieties of tubal pregnancy, which are distinguished according to the anatomical seat of the developing ovum, are as follows: If the ovum is in the part of the tubal canal which perforates the uterine wall, we speak of it as an *interstitial pregnancy.* This variety is not very frequently seen. There have been reported erroneously as interstitial pregnancies, cases which were cornual or where the ovum was located in a blind prolongation of Gartner's duct, which sometimes extends down into the cervix. In interstitial tubal pregnancy, the developing ovum frequently pushes its way into the uterine cavity, and we then have the condition known as *tubo-uterine gravidity.* In it, the gestation sac may be of fair thickness, and the pregnancy may go on to full term and terminate fairly normally.

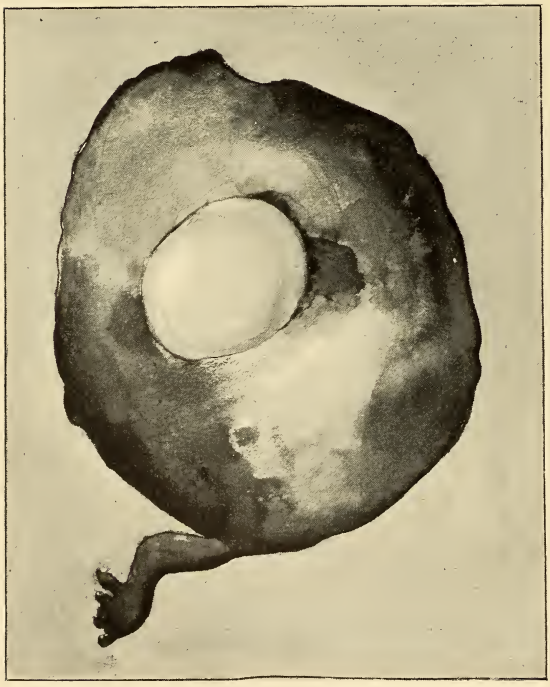

Fig. 278.—The case [of ectopic pregnancy] of Joseph Price. —Herzog (page 653).

The second variety of tubal pregnancy is present when the ovum is found in the middle part of the tube; in which case we are dealing with an *isthmic tubal pregnancy,* or tubal pregnancy *par excellence* (*graviditas tubaria propria*). The placenta in these cases generally has its seat in the lower or posterior part of the tube wall. The gestation sac in this variety is generally very thin and the danger of rupture very great. Here we also sometimes find pedunculated gestation sacs.

Probably the most frequent variety is that of a development of the ovum in the outer third of the tube or ampulla. This kind of ectopic gestation is known as *ampullar pregnancy.* The widest part of the Fallopian tube, the ampulla, naturally offers the

most favourable conditions for an undisturbed development of an implanted ovum. So we frequently find ampullar pregnancy develop much beyond the earlier months of gestation. On the other hand, the funnel-shaped ampulla favours abortion of the ovum. The latter sometimes partly protrudes out of the ampulla into the general peritoneal cavity, and then we have the condition known as *tubo-abdominal pregnancy*. This is, however, not the rule, but the exception in ampullar pregnancy, because there exists already in the earlier months a tendency of the fimbriated extremity to become closed by agglutination of the plicæ. It also occurs that the ovum in ampullar pregnancy protrudes into, and partly develops in, cystic portions of the ovary. This condition can probably supervene only when, early in the course of or prior to ectopic gestation, the fimbriated extremity becomes adherent to the ovary and forms what is called a tubo-ovarian cyst. The form of ecoptic gestation then established is called *tubo-ovarian pregnancy*. That primary true ovarian pregnancy occurs as a matter of fact, is demonstrated by well-authenticated cases, notable among which is an advanced case by Price (Figs. 278, 279) in which the child went to term, projecting on either side from the enlarged ovary; and an early case by Withrow (Fig. 280), the fact of impregnation in the latter having been established by careful microscopical studies by Whitacre. Abdominal and intraligamentous pregnancies are developed from primary tubal gestation. Intraligamentous pregnancy may be brought about in a variety of ways. There may be a rupture of the lower part of the tube wall with more or less hemorrhage and the escape of the ovum between the folds of the broad ligament. The growing ovum may so stretch the lower segment of the tube that it becomes entirely membranaceous, and the sac so formed may unfold the two leaves of the broad ligament. This splitting apart of the layers may also be brought about in such a manner that the ovum completely rarefies the wall of the Fallopian tube at some point, and

Fig. 279.—"The child went to term projecting on either side from the enlarged ovary."—Herzog.

Fig. 280.—"An early case by Withrow."—Herzog.

produces a slit through which it escapes to a spot between the folds of the broad ligament where further development takes place.

Abdominal pregnancy can be brought about in a variety of ways. An ovum located in the tube may be aborted through the ostium abdominale into the general peritoneal cavity. If its placenta is not too seriously damaged, the embryo may, after tubal abortion, go on developing. Rupture of the tube may send the ovum into the general abdominal cavity. The embryo may continue to develop not only when, after primary rupture, its membranes are intact, but even after rupture of the fœtal membranes has taken place.

Course and Termination of Ectopic Gestation.—While almost every variety of ectopic gestation may go on to full term, most cases terminate in the earlier months of development by rupture or abortion. Rupture, in the majority of cases, is brought about by preceding larger or smaller hemorrhages. The latter are of two kinds: small hemorrhages from enlarged tubal vessels into the œdematous and inflamed tube wall, and hemorrhages from the utero-placental sinuses into the intervillous space. The utero-placental sinuses in tubal pregnancy are opened in a more irregular and more extensive manner by the syncytium than is the case in normal uterine pregnancy, and the stretching of the tube wall by the enlarging ovum early establishes a tendency to extensive hemorrhages from the utero-placental sinuses into the intervillous space. These hemorrhages frequently dissect the ovum loose from the gestation sac, and rupture is often initiated in this manner. But even if a rupture does not occur, the embryo may be killed and the ovum arrested in further development in consequence of the intervillous or interplacental hemorrhages. Herzog examined 2 cases of tubal pregnancy operated on before rupture had occurred. In 1 case, the embryo, about five weeks old, was badly macerated. In the other, the embryo, from seven to eight weeks old, looked perfectly fresh and normal (Fig. 281). It was found, however, in both cases that extensive interplacental hemorrhages had taken place, and that the villi in both cases were badly crushed and in an advanced stage of degeneration. If this is the case, the embryo depending for its nutrition upon the villi must, of course, perish in a short time. Herzog thinks that interplacental hemorrhage very frequently precedes rupture for quite an interval of time, because often, even when operation is performed shortly after the symptoms of rupture become manifest, one finds the villi in an advanced state of de-

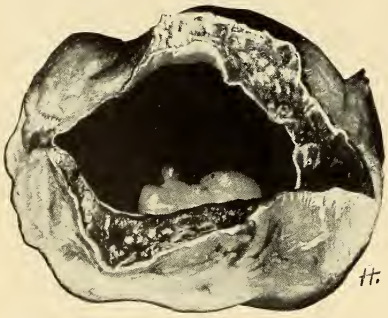

Fig. 281.—"The embryo, from seven to eight weeks old, looked perfectly fresh and normal."—Herzog.

generation. When more or less extensive hemorrhage occurs, either into the tissues of the tube wall or into the intervillous space, rupture generally takes place in consequence of pressure. The hemorrhage after rupture increases as a rule very much, and it may become fatal. The rupture generally occurs at the place where the placenta has been attached. Here, the tissues of the tube wall are often thinned out very much. The cellular elements, particularly the muscle bundles, have been pushed apart, the interstices created are filled out by a serous exudate (œdematous infiltration), and almost the whole thickness of the sac is undermined by the phagocytic action of the syncytium. What becomes of the ovum after rupture, has been indicated already in discussing intraligamentous and abdominal pregnancies.

Tubal abortion is brought about by either of two causes or by a combination of the two. These causes are hemorrhages and contractions of the tube wall. The latter will, however, be impossible when the muscular coat of the tube has been weakened very much by rarefaction and œdematous infiltration.

The embryo in ectopic gestation, as a rule, no matter what occurs, is arrested in its development and dies. Even if it goes on to full development, it must perish unless relieved artificially from its ectopic position. But interstitial tubal pregnancy, when leading to tubo-uterine gestation, may terminate in a natural manner without artificial aid. If the development of the embryo in ectopic pregnancy is arrested early in consequence of rupture or abortion, and if the fœtus gets into the general peritoneal cavity, it is speedily absorbed, so that after a few days there is no trace left of it. Older embryos, arrested in development, become the subject of either *mummification* and *lithopædion formation* or of *maceration*. The latter process usually takes place if the embryo has been deprived of its protecting fœtal membranes. Maceration brings with it the danger of septic infection or putrid changes. The process of calcification of an ectopic ovum may assume one of three forms. If only the fœtal membranes become infiltrated with lime salts, we speak of a *lithokelyphos;* if the fœtal membranes and the superficial tissues of the fœtus are incrusted, we speak of *lithokelyphopædion*, while *lithopædion* proper signifies the condition when the embryo alone presents as a calcareous mass. Lithopædion formation is not infrequently found after the death of a fully developed fœtus has been brought about by spurious labour. A lithopædion may often remain for years in the abdominal cavity without giving rise to trouble, yet may ultimately bring trouble about after having been harmless for a long period of time. Tubal gestation may be a twin pregnancy, and cases of bilateral tubal pregnancy have been observed. Repeated tubal pregnancies have likewise been recorded. Henrotin (*loc. cit.*, p. 386) saw an abdominal pregnancy brought about by an attempt of the patient to produce an abortion in the seventh week of normal uterine gestation. A sharp instrument inserted into the

uterine cavity perforated the fundus. The ovum escaped into the general peritoneal cavity and kept on developing, the placenta spreading from the uterine cavity to the peritoneal coat of the womb. This pregnancy had to be terminated by an operation during the fifth month of gestation.

The uterus in ectopic pregnancy undergoes hypertrophy. The latter is of course mostly confined to the muscular coat. The uterine mucous membrane is changed into a decidua. That this is the case was maintained years ago by Langhans and others. There have been those, however, again and again, who assert that there is no uterine decidua formed in tubal pregnancy. Herzog, who has studied uterine scrapings from a number of cases of tubal pregnancy, finds that a decidua is formed. It is not materially different from the decidua vera as formed in normal uterine pregnancy. This decidua is frequently shed at the time of rupture, abortion, or when the embryo dies from any cause. This accounts for the fact that a number of observers, making an examination at an improper time, have not found any uterine decidua and have been misled into the belief that none is formed in tubal pregnancy. The uterus as a whole in ectopic pregnancy enlarges to the size of a womb in the third or fourth month of normal pregnancy. Beyond this stage it rarely, if ever, hypertrophies; it then either remains stationary or frequently even becomes gradually smaller. This is always the case as soon as the embryo is arrested in its development by rupture, abortion, or otherwise.

The Histology of Tubal Pregnancy.—The study of the microscopic anatomy of tubal pregnancy is by no means an easy matter. By far the greater number of cases are only operated upon after primary or even secondary hemorrhages have occurred, and the material obtained under such conditions is often eminently unsuited to draw trustworthy, valuable conclusions from, as to histogenetic details. Even in cases operated on before any rupture has taken place, there may have occurred intervillous hemorrhages, which will greatly disturb the normal relation of the component parts of the placenta. Of a large number of cases of ectopic gestation, only a comparatively small percentage can be relied upon to furnish valuable material for microscopic examination, and even this can only be properly interpreted by one who has been a faithful, patient student of the histogenesis of the normal uterine placenta, a subject itself offering considerable difficulties. These, of course, become greatly augmented when we deal with an ectopic implantation of the ovum. The following short description of the histology of tubal pregnancy, Herzog bases upon the microscopic examination of over 30 cases. In a book of this kind it would, of course, be very much out of place to discuss in detail all the contested points, of which there are quite a number, in regard to the histogenesis of the normal placenta as well as of that of tubal pregnancy. It will be necessary to be brief and somewhat dogmatic.

From observations recently made by Van Heukelom and Peters upon very young human ova obtained *in situ* in the uterus, it appears that the human ovum, like that of other mammals, is surrounded, soon after fecundation, by a layer of solid ectoblast, called "trophoblast." In this, many nuclei but no individual cell boundaries are distinguishable. The trophoblast, as it appears, has phagocytic properties and enables the ovum to corrode its way into the uterine mucosa, which at this early time has already assumed the character of the decidua. If this is the normal *modus operandi*, and the observations cited very strongly suggest that it is so, it is easy to understand how an impregnated ovum may implant itself into the tubal mucosa. The mode of implantation would be exactly the same as in the uterus, because it depends chiefly, if not exclusively, upon structures and properties of the fertilized ovum itself. From the trophoblast are later on developed the villi with their two ectodermal layers, viz., the inner cell layer of Langhans and the outer, nucleated plasmodium, the syncytium. The very first stages of placental formation have never been observed in ectopic pregnancy.

Fig. 282.—"A differentiation into a decidua compacta and a decidua spongiosa."—Herzog (page 658).

Fig. 283.—"The pseudo-gland spaces . . . have been formed by the deeper recesses between the original plicæ."—Herzog (page 658).

If we turn to what has been observed, the following outlines may be given: The early placenta fœtalis in tubal pregnancy is in no way different from the same structure in normal uterine development of the ovum. The villi possess a mesodermal core with fœtal blood vessels and a double ectodermal lining, the cell layer of Langhans and the syncytium. The placenta materna presents a decidua serotina not so well de-

veloped as in normal uterine pregnancy, but showing large typical decidual cells and a division into a decidua compacta and a decidua spongiosa (Fig. 282). The open spaces in the spongiosa are frequently lined by high columnar epithelium. This may also, however, be more or less flattened, or it may have degenerated entirely and be found to have dropped off into the lumen of the pseudo-gland spaces. The latter have been formed by the deeper recesses between the original plicæ of the tubal mucous membrane (Fig. 283). The changes which the plicæ undergo in tubal pregnancy consist in a club-shaped thickening and a transformation of the fine connective tissue spindle cells into elements of the character of decidual cells. The plical blood vessels become enormously dilated to form the tubo-placental blood sinuses. Neighbouring plicæ become confluent at their higher parts, and this gives rise to the formation of the upper compact layer of the decidua, while the deeper recesses between the plicæ give rise, as already stated, to the pseudo-gland spaces, forming in this manner the lower spongy layer of the decidua. The formation of the decidua vera is similar to that of the serotina, but the vera as a rule does not extend very much beyond the place of insertion of the ovum. The formation of a decidua reflexa, or capsularis, in tubal pregnancy has been denied. Herzog has, however, reported an instance that is beyond doubt. If the above-described mode of implantation of the human ovum is correct, as it most probably is, then the formation of a capsularis, or decidua reflexa, in tubal pregnancy is very easily explained. Herzog has previously insisted upon the fact that a decidua reflexa must always be formed in tubal pregnancy. He says in connection with this subject (*The Practice of Obstetrics by American Authors*, 1899, p. 362): "At an early period in uterine gestation an intervillous space filled with maternal blood, bounded on the outside throughout most of its extent by the decidua reflexa, surrounds the whole chorion. In tubal pregnancy, therefore, there must also always be formed a decidua reflexa, because an intervillous space capable of maintaining the maternal blood can be formed only by a decidua reflexa, unless we assume that the tube very easily becomes obliterated on both sides of the ovum. Since we have no proof at all of such a very improbable occurrence, a decidua reflexa becomes an absolute necessity for the establishment of the intervillous space." This was written before the observations of Peters on a very young human ovum were published. These have since furnished some much-desired elucidation about the establishment of the intervillous space and the formation of the decidua reflexa. This brings us to the question of the intervillous space in ectopic pregnancy. How a recent writer (Kuehne, *Beiträge zur Anatomie der Tubarschwangerschaft*, Marburg, 1899) can state with all seriousness that an intervillous space with maternal blood is never formed in tubal pregnancy, is a matter difficult to understand. If we consider that tubal pregnancies have gone to full term and have been terminated by the delivery of a living child, we must insist from merely theoretical reasoning upon the estab-

lishment of an intervillous space with maternal blood. But aside from any theoretical reasoning, we find favourable cases enough which permit us to recognise an intervillous space (Fig. 284).

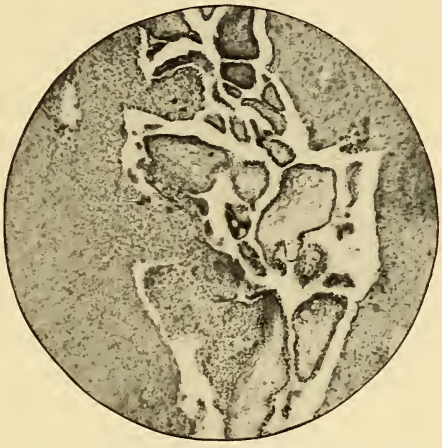

Fig. 284.—"An intervillous space."—Herzog.

The changes going on in the muscularis of the tube consist in a hypertrophy of the muscle cells. As in the uterus, their number does not seem to be increased, but each individual fibre becomes enlarged. The number of muscle cells normally found in the tube is, of course, very small compared with the number found in the muscularis of the uterus. The gestation sac formed in tubal pregnancy consequently must soon be very inadequate in thickness, and œdematous infiltration and inflammatory changes must take place (Fig. 285). This, of course, as is seen in every single case, always comes to pass. Microscopic examination of the gestation sac shows that the bundles of muscle fibres become separated by interstices. These are often filled out with fibrous connective tissue, but frequently we only find an œdematous or serous material between the muscle bundles. The whole tube wall, including the decidua, is infiltrated with cellular elements of an inflammatory type, such as polynuclear leucocytes and lymphocytes; plasma cells are likewise found. This inflammatory reaction is brought about by coagulation necrosis, in consequence of pressure and pulling and smaller and larger apoplectic insults from enormously enlarged tubal vessels. But all of these changes, which as a rule only become pronounced when the ovum has reached a certain size, do not seem to be sufficient to explain very early ruptures. It appears to Herzog that one of the most important, if

Fig. 285.—"Œdematous infiltration and inflammatory changes must take place."—Herzog.

not the most important, factor in the production of early rupture in tubal pregnancy, is furnished by the behaviour of the syncytium. The latter in tubal pregnancy displays greater phagocytic properties or greater penetrating powers than in normal uterine gestation. In the latter we see the syncytium often penetrate deeply into the decidua. But it appears that the uterine muscularis offers to the further progress of the syncytium an obstacle as a rule unsurmountable. It is different in tubal pregnancy. Here there is no strong, solid, dense muscularis. We have on the contrary a rarefied, œdematous tissue, and in it one can frequently see that the syncytium penetrates through almost the entire thickness of the gestation sac. It is this circumstance which appears to Herzog as of the greatest importance in bringing about the conditions which lead to early rupture in tubal pregnancy at a time when the pressure of an enlarging ovum can not yet be held as adequately responsible for the accident. The extensive penetration of the syncytium, as found in specimens of tubal pregnancy, reminds one forcibly of the syncytial proliferation as found in placentoma malignum. Decidualike cells are also found in the outer layers of the gestation sac, and one occasionally meets decidual masses on the peritoneal covering of the tube. Here these decidualike structures are furnished by proliferating peritoneal endothelium.

Fig. 286.—"The corpus luteum verum."—Herzog.

Operations for ectopic pregnancy furnish excellent material for the study of the histology of the corpus lutem verum (Fig. 286). One is surprised to find occasionally that the ovary of the side on which the tubal pregnancy occurred does not show a corpus luteum verum but that the ovary of the opposite side contains this structure. This observation, not infrequently made by a number of workers on the subject, has given rise to the probably correct notion that tubal pregnancy is occasionally the result of an impregnated ovum wandering from one side to the opposite tube. Here the ovum becomes implanted before it can reach the uterus and gives rise in this manner to an ectopic gestation.

Symptomatology.—The symptoms of ectopic pregnancy of course vary with its progress, according to the integrity of the sac, and to whether the fœtus is living or dead. In the early period the ordinary signs of pregnancy are to be observed. Among these, cessation of

menstruation, nausea, and changes in the breasts are to be mentioned, though any and all of these symptoms may be absent, or modified by individual peculiarities. As a rule, however, menstruation is delayed or missed; and the patient exhibits sufficient of the classical symptoms of pregnancy to direct attention to the probability of such a condition. The recurrence of menstruation, which is usually irregular and profuse, is a part of the early history of this condition; and the shedding of the decidua in the form of shreddy discharges, constitutes a valuable diagnostic symptom of the early period.

The objective symptoms consist of an enlarged uterus with softened cervix simulating normal pregnancy, and with a soft and movable tumour upon one side of the uterus. A microscopic examination of the expelled decidua will often disclose the character of that membrane positively and thereby facilitate diagnosis. Prior to the rupture of the tube, the symptoms are obscure and uncertain and the physical signs are for the most part those of normal pregnancy. When rupture occurs (Fig. 287), which invariably happens by the end of the twelfth or fourteenth week, the symptoms are marked and often most alarming. The pain is sharp and agonizing, and is referred to the pelvis. There is also a bloody flow from the uterus at this time. The patient will usually exhibit the symptoms of profound shock and internal hemorrhage. It is not uncommon for the patient to fall to the floor and suffer profound shock, and, in a large proportion of cases, fatal collapse from pain and hemorrhage will supervene within a few hours. In other cases the symptoms will not be so severe and extreme. The rupture may be only partial and the hemorrhage slight, when the symptoms will be correspondingly light and transient. After a brief interval varying from a few hours to several days, the rupture will extend with renewed pain and pronounced symptoms of intra-abdominal hemorrhage. Associated with this condition will be general abdominal tenderness; followed later, if left alone, by symptoms of peritonitis. With primary intraperitoneal rupture there is hemorrhage, but the detection of effused blood inside the peritoneum is difficult and uncertain; hence in this condition bimanual examination will avail but little at first in detecting the effusion. Later, when the blood has gravitated and coagulated, the physical signs elicited by bimanual examinations will show the pelvis to be filled with a semisolid mass.

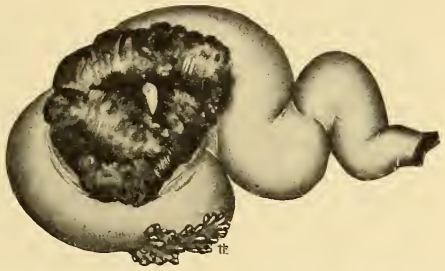

Fig. 287.—"When rupture occurs . . . the symptoms are marked."—McMurtry.

When tubal abortion occurs, the symptoms may be of such limited severity as to deceive the patient and physician as to the nature of the illness. The ovum is detached from its bed in the ampullar extremity

of the tube and, with the accumulated blood of successive hemorrhages, forms a mass to become absorbed or to be walled off by adhesions. The general symptoms will be those of a tender, boggy mass and localized peritonitis, readily confounded with other forms of tubal disease. When rupture occurs with cleavage of the folds of the broad ligament, but without rupture into the general peritoneum, the symptoms are very obscure. The pain is paroxysmal, is prone to recur, and varies as to its severity. The symptoms of collapse are not so severe as when intraperitoneal rupture occurs, due to the limited hemorrhage—limited because of the resistance of the inclosing layers of the broad ligament. This is the form of ectopic pregnancy which permits continued vitality and development of the fœtus. Secondary rupture takes place later into the peritoneal cavity, and may occur so soon after primary rupture that they can scarcely be distinguished. Few fœtuses survive the fourth month, and the symptoms during these months result from the ruptures of the investing tissues, and the hemorrhages associated inevitably with these changes. After the fourth month, if the fœtus survives, the symptoms are those of intrauterine pregnancy with the modifications which would reasonably obtain under the altered environment of the growing fœtus.

Diagnosis.—From the above exposition of the symptoms of ectopic pregnancy, diagnosis will be approximately made in most cases before bimanual examination is utilized. When the history and symptoms are considered in conjunction with careful bimanual examination, the diagnosis will, as a rule, be readily established. Diagnosis during the first week and prior to rupture is rarely practicable, not only on account of the vague and obscure character of the symptoms, but also from the fact that the symptoms are rarely sufficiently active to impel the patient to seek medical advice. Menstruation is absent or retarded during this stage, and hemorrhage coming on later marks the shedding of the decidua. Physical examination is of doubtful significance, as the unruptured tube may be displaced posteriorly or may recede from the examining fingers as does a cystic ovary or hydrosalpinx. Under these circumstances, the general symptoms of nausea and changes in the breasts and uterus will afford those presumptive indications upon which a tentative diagnosis will be made. When the primary intraperitoneal rupture takes place, the symptoms of severe localized pain, varying in degree with the extent of rupture, together with the indubitable signs of intraperitoneal hemorrhage, readily establish the diagnosis. This generally occurs about the seventh week and is usually the first positive symptom that impels the patient to seek advice. Ectopic pregnancy is most frequently observed in women with pre-existing pelvic disease, which fact renders slight menstrual disturbances of minor significance. A vaginal examination at the time of rupture is often negative on account of the presence of pain and muscular contraction. After the paroxysm of pain has passed, a mass on one side of the uterus will be apparent to the bimanual touch. The diagnosis, however, is deter-

mined more by the distinct indications of hemorrhage than by the detection of a tumour. General abdominal tenderness is usually present with the symptoms of shock and collapse.

When the rupture is into the fold of the broad ligament, the pain is more variable as to its severity and is usually paroxysmal. The shock is correspondingly less marked and the volume of effused blood is limited by the resistance of the peritoneal folds composing the broad ligament. When the rupture occurs into the broad ligament very early in the period of pregnancy, the pain and hemorrhage may be very slight and may pass unrecognised as if the condition was one of ordinary menstrual pain or colic. Such cases often recover entirely without treatment, the ovum, secundines, and effused blood being absorbed. When secondary rupture into the general peritoneal cavity occurs in this form of tubal pregnancy, there is a recurrence of pain, with the symptoms of hemorrhage and shock very similar in character and severity to primary intraperitoneal rupture.

If the ovum survives after secondary rupture by retaining sufficient vascular attachment to the tubal mucous membrane for its support, an altogether different and more marked series of diagnostic indications makes its appearance. These advanced symptoms are marked after the fourth month and are both general and local. The general diagnostic symptoms are those characteristic of advanced pregnancy, and consist in absence of menstruation, changes in the breasts, vulva, and uterus, abdominal enlargement, movements of the fœtus, placental souffle, and ballottement. Palpation of the fœtus is easily made on account of the thinness of the abdominal walls. As a means of diagnosis, palpation is an untrustworthy resource in ectopic pregnancy, since the same impressions may be derived through the walls of an attenuated uterus. McMurtry has had frequent cases of attenuation of the uterus (*American Practitioner and News*) in which repeated examination by several skilled observers gave the impression, in the face of a doubtful history, of ectopic pregnancy nearing full term. Normal delivery demonstrated the true condition to be that of attenuated uterus. In such cases the uterine walls are so thin that the fœtal head, body, and limbs, may be followed by the hands, as if subcutaneous. In the diagnosis of all stages of ectopic pregnancy, the fact that intrauterine pregnancy may coexist should never be forgotten.

When the term of pregnancy is completed (Fig. 288) and spurious labour supervenes, the diagnosis, if not previously made, will be established without special difficulty. The pains are well defined, contractile, gradually increasing in duration and severity, recurring at intervals, and gradually subsiding. After spurious labour and the consequent death of the fœtus, marked changes are observed in the fœtal and maternal structures. The placental circulation continues for some time after the death of the fœtus. The abdomen is usually decreased in size, fœtal movements cease, and the uterus undergoes involution. In a certain proportion of cases, the gestation sac and fœtus undergo

necrotic changes and break down into a gangrenous, suppurative mass. Hectic fever and general septic symptoms of severe type at once appear. After a severe and protracted illness, pus may find outlets, single or multiple, through the abdominal wall, rectum, vagina, or bladder, to be followed by the *débris* of the macerated fœtus. In some instances, the fœtus undergoes mummification, calcification, or is converted into a lithopædion, so that the septic symptoms mentioned may be modified or be altogether absent, in accordance with these varied methods by which the fœtus and secundines are managed by the digestive activity of the peritoneum.

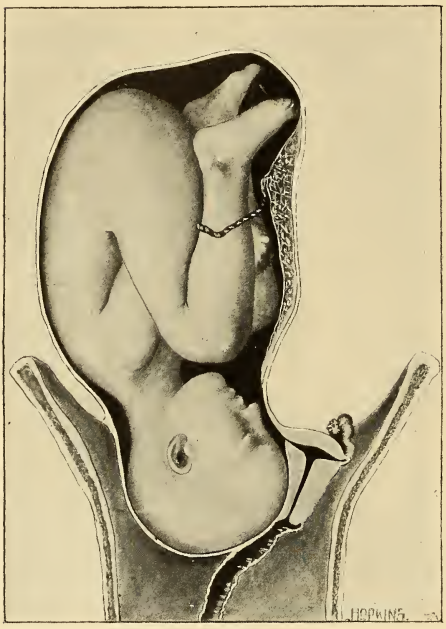

Fig. 288.—"When the term . . . is completed . . . the diagnosis . . . will be established without special difficulty."—McMurtry (page 663).

Treatment.—In the pre-antiseptic era of surgery, many methods of treatment were devised to arrest the development of the misplaced ovum and to promote its absorption. Among these may be mentioned the administration of strychnine to a toxic degree, hypodermic injections of ergot, and puncture of the cyst. More recently, the injection of morphine into the sac, and later the application of electricity, have been in vogue to destroy the fœtus and to facilitate innocuous absorption. All these methods of treatment are now obsolete, and proper surgical treatment is the only method deserving confidence. In no field of surgery have the results been more brilliant than in the treatment of ectopic pregnancy. A certain proportion of the cases of ectopic pregnancy in which rupture occurs during the early stages, recover without operation. Some present themselves to the gynecologist weeks or months after rupture, with the symptoms of pelvic inflammation of tubal origin. Abdominal section will reveal an old and infected blood clot, the removal of which will be followed by prompt recovery. These cases were formerly classified under the head of suppurating hematocele (Fig. 289). While recovery may eventually take place under expectant methods of treatment, the larger proportion will be saved by prompt abdominal section and removal of the affected tube and its contents. In the following classes of cases, viz.—1. Unruptured tubal pregnancy; 2. Cases of rupture without severe symptoms; 3. Cases of

rupture with developing infection, Schauta has shown that the mortality of ectopic pregnancy, when uninterfered with, is over 65 per cent, while the mortality in cases treated by prompt surgical intervention is less than 6 per cent; from which it is apparent that the patient is exposed to greater peril by expectant treatment than by early resort to surgery. As heretofore stated, few cases of ectopic pregnancy will present themselves for treatment prior to the time of rupture, consequently it is exceptional that an opportunity is found for the simple and safe operation practicable at this stage. The *operation* consists of abdominal section and removal of the involved tube in a patient free from shock or hemorrhage, and where the condition is uncomplicated by inflammatory lesions.

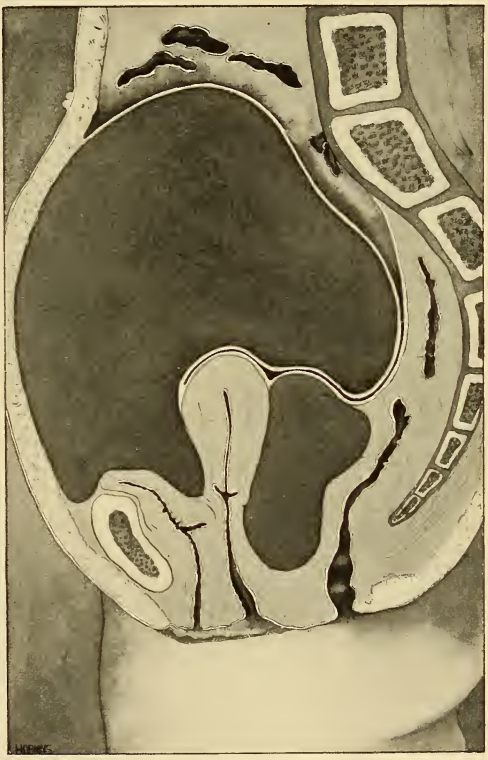

Fig. 289.—"These cases were formerly classified under the head of suppurating hematocele."—McMurtry (page 664).

When rupture has occurred, especially if with extensive lesions directly into the general peritoneum, immediate operation is a necessity to save life. The case is one of hemorrhage, and to arrest the bleeding is as imperative here as to secure the severed ends of a wounded blood vessel in other localities. The operation in these cases is one of emergency, oftentimes to be done immediately upon seeing the patient and recognising the condition, with all the haste that is compatible with due regard to reasonable aseptic operative precautions. When the peritoneum is incised through an abdominal incision, blood clots will present themselves through the incision. These must be rapidly turned out, the ruptured tube sought with the exploring fingers, and secured with a clamp. The hemorrhage having been arrested by this manœuvre, the operator can deliberately ligate the ruptured tube at the uterine cornu, and cleanse the peritoneum of all fresh blood and clots. When primary rupture has preceded operation for a sufficient time, old and disintegrated blood clots will be found. Irrigation with hot saline solu-

tion will subserve a double purpose in removing these clots, and, by rapid absorption through the peritoneum, in overcoming the associated shock and anæmia. During the progress of the operation in these cases, as well as prior and subsequently to that procedure, hypodermic medication and saline infusion should be applied to maintain the circulation. McMurtry has had the gratifying experience of witnessing the return of the pulse at the wrist under this treatment, when the patient seemed beyond surgical aid from the severity of the hemorrhage. The anæsthetic should be given barely to the point necessary for permitting the operation without pain, and should be laid aside at the earliest possible moment in order to avoid adding anything to the profound shock already existing. Ether is to be preferred in these cases on account of its stimulating effect. The question of drainage must be determined by the indications of individual cases. Where irrigation has been required, drainage for twenty-four hours by means of a glass tube will usually prove advantageous, and will also give assurance as to hemostasis. When the patient is placed in bed, dry heat should be applied and the foot of the bed elevated. When a patient has passed safely the immediate danger from rupture, with the pelvis filled with blood clots and membranes undergoing septic changes and suppuration, it may be best, if she has become feeble from sepsis, to incise the fornix vaginæ and remove disorganized clots and septic foci, thereby providing an outlet and securing drainage. In all other conditions, the surgical requirements of ectopic pregnancy will be best subserved by abdominal section rather than by vaginal incision.

The operative treatment in advanced ectopic pregnancy will vary as the fœtus is living or dead, and according to the consequent state of the placental circulation. The placental site varies in these cases, and may be on the abdominal wall, in the uterus, or spread out most frequently over the broad ligament and uterus; in some cases it is also attached to intestinal and bladder surfaces. After spurious labour and the death of the fœtus, the placental circulation remains active for some time. Hence, under these circumstances it is best to defer operation for several weeks in order that the placental thrombi may become organized. Then the placenta can be enucleated without serious danger from uncontrollable hæmorrhage. The danger to life in those cases where the pregnancy has advanced beyond the fifth month, and especially in those that have gone beyond full term, is extreme. The difficulty centres about the removal of the placenta. When the placenta is spread out over the uterus and intestines and the circulation through it is active, a fatal hemorrhage will usually follow any attempt at its removal. If this condition is found to exist, the cord is tied and cut short after removal of the fœtus, and the sac is stitched to the edges of the incision after packing it with gauze which is allowed to protrude from the lower angle of the incision. The danger here, too, is great; for the large mass is readily infected, and secondary hemorrhage will often ensue as the placenta breaks down. When the fœtus is alive

and viable, operation should be done without waiting for the completion of the full term of pregnancy and spurious labour. In opening the abdomen, the sac should be avoided carefully by diverting the line

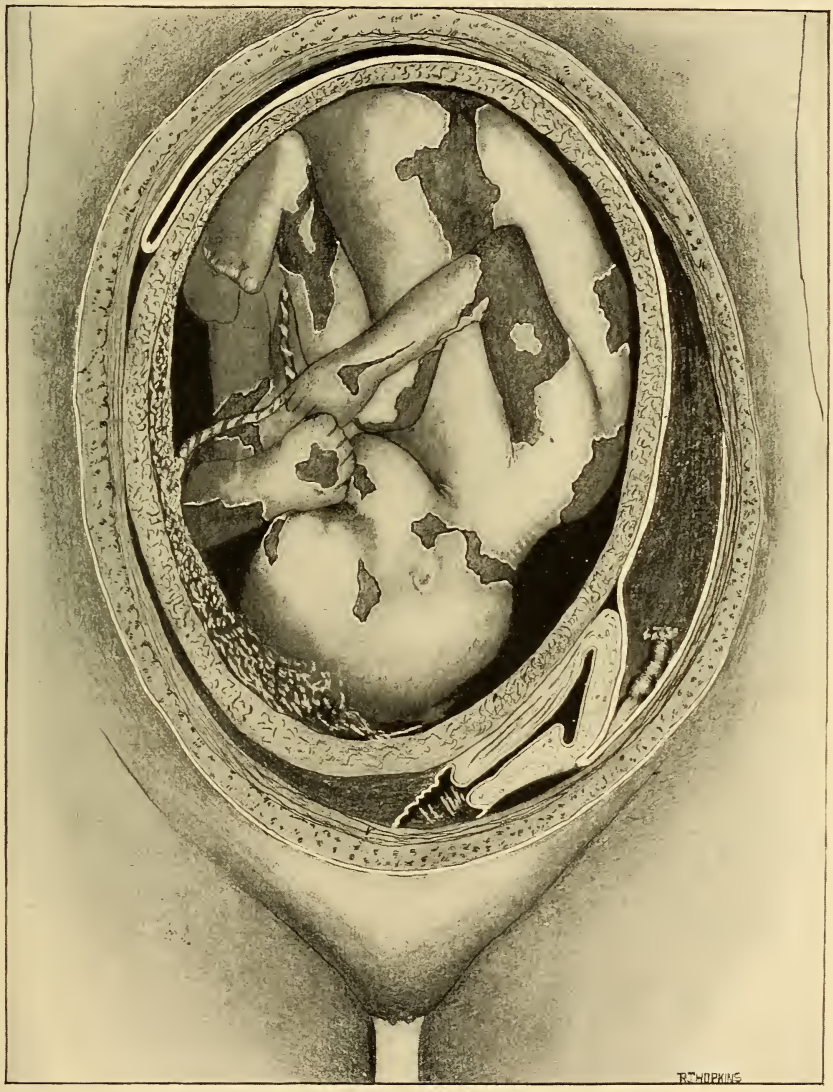

Fig. 290.—". . . A patient who had gone two months beyond term, maceration of the fœtus having commenced."—McMurtry (page 668).

of incision. When the sac is opened, the child is extracted and handed to an assistant. If the placenta is favourably situated, it may be rapidly enucleated and the hemorrhage controlled by firm gauze pack-

ing. Otherwise, it may be best to leave the placenta as already described.

When the fœtus has been dead for several weeks, the dangers of operation are much lessened. In these cases it will often be practicable to remove the placenta at once without severe hemorrhage. When the fœtus has been long dead and has undergone mummification, adipocere change, or calcification, the operative procedure for its removal

Fig. 291.—"The child was removed by abdominal section."—McMurtry.

will present no additional difficulties, and can be conducted in accordance with the principle already set forth in this chapter. Reed operated on a patient at the Cincinnati Hospital who had gone two months beyond term, maceration of the fœtus having commenced (Fig. 290). The child was removed by abdominal section (Fig. 291) and the sac sutured to the margins of the wound and packed with gauze, as the slightest traction on the placenta induced hæmorrhage. The placenta was subsequently removed, and the patient made a complete recovery.

CHAPTER XLIII

NEOPLASMS OF THE BROAD LIGAMENT

The broad ligament—Varieties of neoplasms—Cysts (parovarian), origin, causes, symptoms, complications, diagnosis, treatment—Hydrocele of the round ligament—Fibroma, myoma, and lipoma; symptoms, diagnosis, treatment—Dermoids—Solid tumours of the round ligament—Pelvic varicocele—Aneurismal varix and phleboliths—Malignant neoplasms: Carcinoma; sarcoma.

The broad ligaments consist of folds of peritoneum, extending from the uterus to the bony wall upon either side of the pelvis. On the upper margin of each of these peritoneal folds, and extending lengthwise with it, is the Fallopian tube, the fold beneath it being frequently designated the mesosalpinx. Attached to the posterior fold of the broad ligament, near its outer extremity, is the ovary. There are various structures contained within and beneath the folds of the broad ligament. It is necessary in this connection to consider only (*a*) the *round ligament*, which extends from the uterus to the inguinal ring, and over which there drops a sort of duplication of the peritoneum, usually designated the anterior fold of the broad ligament; (*b*) the *parovarium*, or the rudimentary survivor of the Wolffian body; (*c*) the *blood vessels*; (*d*) the *lymphatics*; and (*e*) *unstriped muscular fibres*. Each of these several structures may present pathologic changes demanding consideration.

Neoplasms developing within the broad ligament may originate from any of the structures therein contained. They may be considered under the two classes of (*a*) benign, and (*b*) malignant.

Benign enlargements, some of which are not, strictly speaking, of neoplastic character, but which, for convenience, are grouped together in this chapter, are:

1. Cysts arising from the inner tubules of the parovarium.
2. Fibromata arising from the fibrous connective tissue.
3. Myomata arising from the unstriped muscular fibres.
4. Fibromyomata arising from the two preceding.
5. Lipomata arising from the areolar tissue.
6. Dermoids arising from the connective tissue.
7. Varicocele arising from the dilated veins.
8. Aneurismal varix arising from the increased number and enlargement of blood vessels.

9. Phleboliths arising from the calcareous infiltration of thrombi.
10. Hydrocele arising from the round ligament.

Malignant Neoplasms:

1. Carcinomata
2. Sarcomata } are generally secondary deposits.

Cysts developing in the broad ligament may arise from (*a*) the epoöphoron (parovarium), (*b*) the paroöphoron, (*c*) the round ligament (hydrocele). It is important as a preliminary step in this connection to consider more in detail these various structures—particularly the two former.

Notwithstanding that M. Sänger, W. Fischel and Werth (*Archiv für Gynäkologie*, Bd. xv, xvi) wrote in 1880 extensively, clearly, and correctly, upon the tumours of the broad ligament and of the structures lying between its folds, Doran (*Tumours of the Ovary and Broad Ligament*, 1885) expressed regret that the gynecologists manifested so little interest in the parovarium. Since then, however, most of the writers on gynecology, and the text-books on this subject, speak more or less extensively of this organ and its relation to certain pathologic conditions. While, clinically, the diseases of the parovarium and the mesosalpinx can not, or should not, be considered separate or distinct from those of the ovary, they are, nevertheless, peculiar to organs that are as different from the ovary as is the Fallopian tube; and just as the tubes, and the affections characteristic of them, are dealt with by themselves, so should the diseases of the parovarium and its peritoneal coverings be treated distinctively and form a chapter of their own.

Parovarium is the term first used by Kobelt. Waldeyer called it *epoöphoron*, in contradistinction to the *paroöphoron* (which lies closer to the uterus and represents the vestiges of the corpus Geraldès of the male, the parepididymis). The organ was formerly, and still is, quite generally known also as the corpus Rosenmüller because Rosenmüller gave the first description of it. The *mesosalpinx* is merely a part of the *broad ligament*. The two terms should not be used synonymously.

Briefly defined, the *parovarium* is that portion of the female internal genitalia which represents the atrophic or rudimentary remnant of that part of the Wolffian body that would have become the epididymis in the male.

Anatomy (*Embryology*).—The *parovarium* (Fig. 207) resides between the two folds of the broad ligament, and consists of a number of small, "closed" tubules running transversely in a fan-shaped arrangement from the ovary toward the Fallopian tube. These tubules can be easily detected by the unaided eye, if the normal mesosalpinx is spread out and held up against the light (Quain). The number of tubules varies, as a rule, from 10 to 15, though there may be only half a dozen, or as many as 25 or 30 (H. C. Coe). It is said that they have no openings; that they measure from a little less than 0.5 millimetre to 1 millimetre in diameter; that their walls are 0.05

millimetre in thickness, and consist of an external annular membrane, and an internal membrane of longitudinal fibres (Olshausen), lined with cuboidal or low cylindrical, and sometimes ciliated, epithelium; and that they are surrounded by several layers of spindle cells, apparently nonstriped muscular fibres (H. A. Kelly). The longest and largest of these tubules, which is the remnant of the Wolffian duct, runs parallel to the Fallopian tube along the base of the fan formed by the rest, and then extends to the side of the uterus and becomes lost in the vaginal wall. According to Olshausen, the scanty contents of these tubes coagulate on the addition of acetic acid. In some of the lower animals, the sow for instance, the Wolffian duct persists and is known as the duct of Gartner. Occasionally, traces of this duct may be seen in the human female upon cross section of the cervix or body of the uterus. Those of the vertical tubules terminating near the outer margin of the broad ligament are, by some authors, called Kobelt's tubes, and it is at their extremities that, very often, small transparent cysts develop, the so-called hydatids of Morgagni.

The *origin of cysts developing in the broad ligament* is, principally, from the epoöphoron (parovarium). Occasionally, though rarely, cysts may arise from the paroöphoron, which lies close to the uterus. When small, we can distinguish between them only by their location, the former occupying the outer and upper, the latter the inner and lower, portion of the broad ligament; when large, whether pedunculated and extending into the peritoneal cavity or subserous, their origin can not be positively determined.

The *parovarian cystoma* (Fischel, *Archiv für Gynäkologie*, Bd. xv, pp. 214, 215) is the result of a cystic degeneration of that part of the parovarium which not only extends into the hilum of the ovary, but is found where Pflüger's loops begin to have granulosa-epithelium, and that is within the cortical layer of the ovary itself. The ovarian tissue, during the development of these tumours, either atrophies or participates in the formation of the same. These growths have the same physical characteristics as those that form from the epoöphoron and paroöphoron respectively, because they are in reality of parovarian origin. They, too, remain intraligamentary; but frequently become pedunculated and differ from the rest only in containing ovarian tissue, which, however, can not always be found.

History.—Up to 1865, little or nothing was known of broad-ligament cysts. It is through the observations and reports of cases by Prochownik, Schröder, Olshausen, Spiegelberg, Gusserow, and others, that we know something definite concerning these neoplasms. But to Wilhelm, Fischel and Olshausen (1880) belongs the credit of first describing minutely, macroscopically and microscopically, their structure and relations, which, as will be seen, are of no little importance.

The *frequency* of their occurrence has never been rightly estimated. Formerly, they were considered quite rare. It is now well known that

they are much more frequent than is ordinarily supposed. While they are met with less often than ovarian cysts, it must not be forgotten that many a cyst has been diagnosticated as belonging to the ovary, which, in truth, was parovarian in its origin.

Cysts of the broad ligament may develop at any time of life, but more especially after the period of puberty. Olshausen's youngest patient was fifteen, Kelly's oldest, seventy-three years of age. As a rule, they are monocysts, and vary in size from 1 centimetre to 40 centimetres in diameter. The small cysts connected with, or springing from, Kobelt's tubes usually remain small, and do not give rise to any symptoms. Both broad ligaments may be affected with one or several cysts at the same time; or one cyst may so develop as to occupy both ligaments in course of time.

Every parovarian cyst is, necessarily, intraligamentary. In a certain sense they remain so; notwithstanding that, in one case, they may grow into the peritoneal cavity and become more or less pedunculated, and that, in the other, the direction of growth is toward the pelvic floor and retroperitoneal space. In the latter case, the tumour spreads the leaves of the ligament or ligaments apart and becomes, to a great extent if not entirely, subserous in its location. Again, the tumour may dissect up the parietal peritoneum anteriorly and posteriorly, or both. Their conduct in this respect is like that of the solid tumours of the broad ligament already described. In consequence of the varying distribution of the parovarian cysts and cystomata, they vary in shape and give rise to different symptoms at a certain period of their existence. Those cysts which develop in the direction of the abdominal cavity will have more or less of a pedicle (when the base of the ligament is not taken up, a pedicle may be often formed by traction upon the tumour during the operation), will be perfectly oval in shape, and covered with peritoneum in every part. Those cysts that grow downwardly, separating the two layers of the broad ligament, become to a great extent irregular in outline, are covered by peritoneum in part only, and, of course, have no pedicle.

Parovarian cysts are, then, either entirely or in part, covered with peritoneum derived from the broad ligament. The outer surface of the cyst or cystoma is, therefore, smooth, and immediately beneath it can be seen the blood vessels running in every direction. The tube and its fimbriated extremity are very much stretched, and extend over the upper and posterior surface of the tumour to which they are loosely, sometimes firmly, adherent (Fig. 292). The fimbriæ, especially the fimbria ovarica, are spread open and very much elongated. The tube, as a rule, continues patulous and unchanged in its structure. The ovary, often perfectly normal, may be found suspended from, or flatly attached to, the lower and posterior surface of the growth. When the ovary can not be found, it may be atrophied and lost in, or become part and parcel of, the tumour itself. The latter event occurs, according to Fischel, in the ovarian cystomata of parovarian origin.

The cyst wall is made up of peritoneum, glandular, muscular (smooth), and connective tissues. Its inner surface is lined with ciliated epithelium (Fig. 293), either alone, or in connection with the

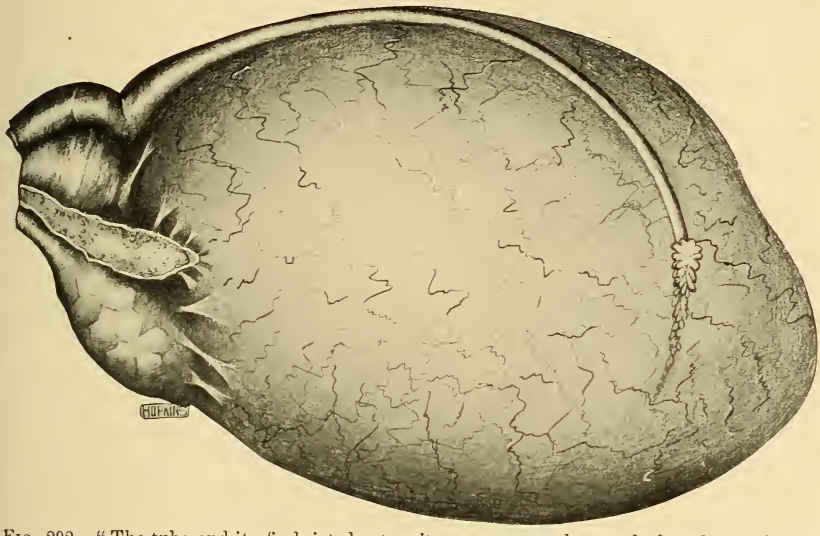

Fig. 292.—"The tube and its fimbriated extremity are very much stretched, and extend over the upper and posterior surface of the tumour."—Zinke (page 672).

cylindrical variety. The thickness of the wall varies, usually from 0.3 to 3.5 millimetres, although, at times, it may be much thinner or thicker; but it is nearly always uniform and seldom shows transparent patches. Its inner surface is corrugated, and not infrequently studded extensively with papillary formations. The corrugation Fischel believes to be due to the presence of muscular fibres in the cyst wall; Olshausen and others, however, do not agree with him. The smooth muscular fibres are found nearer the outer surface of the wall and run in every possible direction; they may be absent in spots.

Fig. 293 (Pfannenstiel).—"Its inner surface is lined with ciliated epithelium."—Zinke.

The glands found by Fischel, which he states are lined with a low cylindrical epithelium, can not always be detected. Olshausen believes that both glands and papillary formation are more generally absent than present.

The fluid contents of the sac, too, vary much in colour, consistence, and specific gravity. This depends, mostly if not always, upon the

age and size of the tumour and the amount of blood that, from time to time, may escape into it in consequence of occasional rupture of blood vessels, the result of torsion of the pedicle, distention or puncture of the cyst wall, or external injuries. In by far the great majority of the small and medium-sized tumours, the fluid is clear and limpid like water, sometimes of a yellowish tinge, sometimes opalescent, and contains little or no albumin. The specific gravity is exceedingly low, 1002 to 1004. Under these conditions, too, the cyst wall is often flaccid. When the cyst is old and large, the fluid is likely to be thick, much darker in colour (greenish brown or black), and may contain considerable albumin and have a high specific gravity, 1022 as in Schatz's case. Sometimes blood coagula, old and of recent date, may be discharged from the cyst when opened. Spiegelberg says that the parovarian cysts may also contain "paralbumin, granular *débris*, decolourized and shrivelled red blood corpuscles, scattered white corpuscles, large granular fat cells, and plates of cholesterin."

Causes.—The causes of intraligamentary cysts and parovarian cystomata are very obscure. Indeed, we must admit that we do not know. The following are merely of a speculative nature: Menstrual congestion; hereditary predisposition; chlorosis during puberty (Scanzoni). Irritation, as from displaced or diseased pelvic organs and other sources, may be admitted as a probable cause. Olshausen states that they are rare in childhood; that no period of life is exempt, and that they are often associated with ovarian disease of the same or the opposite side.

Symptoms, Complications, and Diagnosis.—These may best be considered under one head. Partly and completely pedunculated parovarian cysts, or cystomata free from all complications, may not give rise to any symptom whatever, except when they assume great proportions; and then the symptoms may be limited to enlargement of the abdomen, dyspnœa, dulness, and distinct fluctuation on percussion. It is different when there is no pedicle and cysts develop, in part or entirely subserously. Pelvic discomfort and occasional pains may be present early, and may gradually increase in frequency and duration as the tumour grows and dissects up the pelvic and parietal peritoneum, and displaces the viscera concerned. Advice is sought early and examination usually permitted. Inspection of the abdomen may reveal some enlargement; percussion, some dulness in the lower part of the abdomen; and bimanual examination, a fluctuating swelling with upward, downward, anterior, posterior, or lateral, displacement of the uterus and some of its appendages. Here, too, there will be noticed a steady augmentation of the symptoms. The bladder will become disturbed in its position and this may cause frequent, painful micturition or even incontinence of urine. The rectum may be affected in the same way. The symptoms, then, in all uncomplicated cases, will vary according to the size, age and locality, of cysts. As they are of very slow growth and sometimes stationary, other conditions may give

rise to complications, as, for instance, pregnancy, rupture of the cyst, torsion of the pedicle, diseases of the uterus and its appendages, etc. The physician may be consulted for any one of these or for several of them, and may discover the presence of a parovarian tumour by accident rather than otherwise, either by his examination, or while operating in the abdominal cavity for other diseases or injuries. It is evident, therefore, that the diagnosis is not always easy, and that errors may be made; but let it be remembered that fluctuation is nearly always very distinct and superficial, as in ascites, and that, if the cyst wall is flaccid, the percussion note may change slightly with the change in posture of the patient. If a spontaneous rupture takes place, there may be no symptoms. This, it is said, may happen repeatedly, without even a suspicion on the part of the patient, and may be eventually followed by recovery. Rupture of the cyst, spontaneously or accidentally, is always followed by diuresis; often, it is also followed by pain, in the absence of complications; and always by pain, sometimes by shock, and occasionally by sepsis and death, if this accident occurs in the presence of acute or chronic inflammatory suppurative complications. That there are cases in which a diagnosis can be made, can not be doubted. When we find a flaccid abdominal tumour, with distinct fluctuation and devoid of hard nodules, which is of slow growth, accompanied by a hstory of the absence of pain, and, possibly, of repeated rupture without serious consequences, it seems safe to conclude that we are dealing with a broad-ligament cyst. But it may be wise not to be too positive even then. At the present high stage of development of abdominal and pelvic surgery, puncture of any cystic growth for diagnostitial purposes must be mentioned only to be condemned.

To distinguish between a papillary parovarian cystoma and a multilocular cyst of the ovary, we need only remember that the former is mostly, if not always, bilateral; that it is always intraligamentary, and that the inner surface of the cyst is lined by ciliated epithelium.

Treatment.—The treatment of parovarian and other cysts of the broad ligament is very much like that of the solid tumours of this structure. Formerly, puncture of the cyst was earnestly advised, and is still held out, by some, as worthy of trial now. Zinke can not subscribe to this view. It may be true, though he is inclined to doubt it, that some patients have been cured by this means. He does not doubt that hundreds of women afflicted with these growths have each been successfully tapped many times, and, in some instances, hundreds of times; but he knows, also, from personal experience and the experience of others, that in the great majority of all the cases so treated, nearly all were but temporarily relieved and eventually died of exhaustion. In some, adhesions were caused that subsequently complicated the extirpation of the growth; and in others, conditions were established that resulted in the death of the patient, as the result either of carelessness or of errors in diagnosis. There is no class of cases that, when free from complications, recover more promptly from

radical operative procedures when done under strictly aseptic precautions than these. The pedunculated variety, especially, admits of easy removal of even very large tumours and through a very small incision. Those cases which develop within the broad ligament without a pedicle, are often shelled out with ease, and not unfrequently a pedicle may be made of a part of the base of the broad ligament not taken up by the cyst, and of a part which is stripped from the latter during its enucleation. In the class of cases that are entirely subserous or extraperitoneal, as in the solid tumours of the broad ligament, enucleation of the entire cyst may be accomplished and the cavity left treated in the same way as recommended under Treatment of Solid Intraligamentary Tumours.

Should the removal or enucleation of a cyst seem, for any reason, impossible, or, on account of existing complications, inadvisable, then the plan of removing part of the cyst and stitching the edge of the remaining portion to the abdominal wound for the purpose of packing and drainage, as first advised by Spencer Wells, and practised by Olshausen, Winckel, Sänger and others, may be resorted to, and complete recovery confidently expected. Some of our German *confrères,* also, state that, in the absence of complications, the sewing of the remaining portion of the sac, as just described, is really unnecessary; because its contents and what may be subsequently secreted, will be readily absorbed by the peritoneum; the sac eventually shrivels up, atrophies, and the patients recover perfectly and permanently.

An important innovation in the *technique of operations for intraligamentary cysts,* was devised almost coincidently, and with equal originality, by Hall of Cincinnati and Hawkins of Denver. The method, which is essentially a supravaginal hysterectomy, is described by Hall as follows:

"Open the abdominal cavity in the usual manner. Then, tap the cyst and empty it. Next, ligate the ovarian artery on the tumour side at the pelvic border. Ligate the ovarian artery on the opposite side, outside the ovary if that organ is to be removed, inside it, if it is to be left. Divide the peritoneum crosswise above the top of the bladder and push the bladder down. Ligate the uterine artery on the healthy side. Cut across the cervix, and clamp or ligate the uterine artery on the tumour side. The blood supply is then cut off and the patient has not lost a drachm of blood. The capsule of the tumour can now be divided at a suitable point behind and in front, and the tumour can be enucleated from below upward with much greater ease than from above downward, and with corresponding safety to the ureter, the rectum, and the iliac vessels. Close the peritoneum over the pelvic floor with running sutures of catgut. Every part of the field of operation is in view of the operator." The drawing (Fig. 294) from a specimen of Hall's, shows the extent of the operation.

This operation, which certainly offers the maximum of safety to the patient, is one that necessarily involves the loss of the reproductive

power. This may be a matter of serious moment in certain cases, and should not, therefore, be done, except after the menopause, or when fecundity has been destroyed by disease; or as a matter of emergency, and even then as a matter of policy it is better to have the consent of the patient. Intraligamentary cysts may be removed by enucleation without damage or consequence to the reproductive apparatus, although this is manifestly more hazardous to the patient than is the Hall-Hawkins operation.

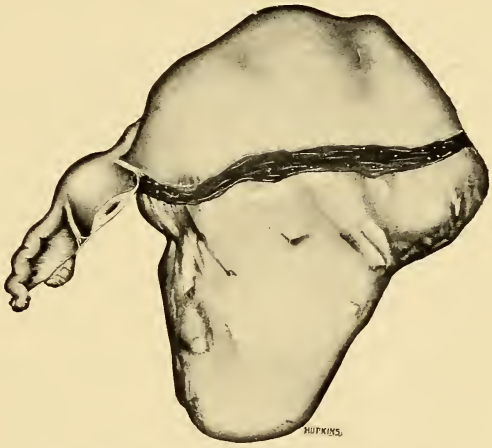

Fig. 294.—"A specimen of Hall's" (intraligamentary cyst).—Reed (page 676).

Hydrocele of the round ligament may develop precisely as does hydrocele of the spermatic cord in the male. The *pathology* is essentially the same in the two conditions, with the exception that, in women, the dropsical accumulation is much more restricted, being as a rule limited to the canal of Nuck; the sac may present at the inguinal ring, or even protrude beyond it, as a fluctuating tumour, suggestive of a hernia with a fusion. It is not ordinarily a painful affection, although it may occasion enough disturbance to attract attention to it, when the exact character of the difficulty may be ascertained. *Treatment* may consist of (*a*) puncture, followed by different varieties of injections; (*b*) free incision of the sac, followed by sterilized tamponade; or, (*c*) extirpation of the sac. The two former methods are painful, tedious, and uncertain—the last-named, alone, being entitled to the designation of radical. Volbrecht operates upon hydrocele of the round ligament, when the sac is large and located high up, by making a section of the inguinal canal in its entire length. The sac is then isolated and cut away, a ligature being placed upon the pedicle; the canal is then sutured, layer to layer, as in the Bacini operation.

Fibroma, Myoma, and Lipoma of the Broad Ligament.—*Fibroma* and *myoma* may develop in the broad ligament as such pure and simple, or combined (*fibromyoma*). They are subject to cystic degeneration in this as well as in other regions of the body (*cystofibroma* or *cystomyoma*). The myoma of the broad ligament is the *leiomyoma* of Ziegler, because it is made up principally of newly developed, unstriped muscular fibres. Prior to 1880, the primary development of these tumours in the broad ligament was almost universally denied.

To M. Sänger (*Archiv für Gynäkologie*, Bd. xvi, 1880, s. 258) be-

longs the credit of establishing a definite clinical autonomy for this variety of intraligamentary neoplasms. He states that Klob, in 1864, questioned the possibility of the independent development of the same; though Kivisch, in 1849, admitted the primary formation of small fibroids, but when he saw large ones, they, in his opinion, could only arise from the uterus. Scanzoni (1875) was of the same opinion; he attributed their origin to small blood extravasations. Even Schröder (1879) denies that fibroma and myoma have their genesis in the broad ligament, notwithstanding that Virchow recognised their primary development in this locality, and Schetelig (*Archiv für Gynäkologie*, Bd. i, s. 459) had described a large "*cystomyoma teleangeiectodes cavernosum* of the right broad ligament," which showed its genuine developmental origin to be from the unstriped muscular fibres of the same. Sänger then quotes the cases of Schmidt (*Prager medicinische Wochenschrift*, 1878, s. 35) and Mikulicz (*Wiener medizinische Wochenschrift*, 1878, s. 19–21). That of the former was a case of fibrosarcoma weighing 8 kilogrammes (17.60 pounds); it sprang from the right broad ligament, had a long, tolerably thick pedicle, and occurred in a patient thirty-three years old. The latter was an œdematous fibromyoma weighing 5 kilogrammes (11 pounds), and developed in the left broad ligament of a nullipara aged twenty-two years, and single. The latter tumour was of slow growth, was complicated with ascites, and had a very thin pedicle. Both patients recovered.

It is interesting to note that even Professor Winckel, so late as 1887, still clung to the idea that myomata of the broad ligament were at first, probably, subserous or intraparietal, and grew from the uterus into the broad ligament; he admits, however, that primary growths have been observed. There is no reference at all to intraligamentary fibroma and myoma in Mann's *American System of Gynecology*, 1888. The same must be said of Thomas and Mundé's *Practical Treatise on the Diseases of Women*, 1891. Senn, in his book on the *Pathology and Surgical Treatment of Tumours*, 1895, p. 511, speaks of the primary formation of myofibromata within the broad ligament, but still maintains that "not infrequently" they originate from the uterus. Kelly (*Operative Gynecology*, 1898) no longer discusses the question, and describes and illustrates a variety of cases. A beautiful representation of a cystic myoma can be found on p. 394, vol. ii, of his work. Baldy (*American Text-book of Gynecology*) devotes not quite one page to the consideration of intraligamentary fibroids, and calls them "exceedingly puzzling." Zinke states that Edwin Ricketts presented 3 cases of intraligamentary fibroids to the Academy of Medicine of Cincinnati, Ohio, weighing severally 16, 8, and 65 pounds. They were removed from patients aged forty-four, fifty-one, and forty-eight years respectively. The last died; the two former recovered.

Zinke also maintains that at this time it is simply impossible to estimate the frequency of these growths. They are rare; but they do occur sufficiently often to demand the full attention of every gyne-

cologist and abdominal surgeon. According to Rosenwasser (*Annals of Gynecology and Pædiatry*, vol. iv, No. 6, 1891)—

Olshausen	found among	280	ovariotomies	20	intraligamentary		
Wylie	"	" 500	"	6	"		
Mundé	"	" 154	"	18	"		
Rosenwasser	"	" 12	"	6	"		
	or	" 946	"	50	"	= 18.85 per cent.	

Sänger (1880) remarks: " I have the conviction that our experience with solid tumours of the broad ligament will be like that with parovarian cysts. At one time believed to be great rarities and practically unimportant, they have been observed so frequently that every laparotomist must take them into account."

The only references Zinke can find to *lipomata* of the broad ligament are contained in Pozzi's *Treatise on Gynecology*, p. 187; in Senn's *Pathology and Treatment of Tumours*, p. 407, which is merely a quotation of the former; and in Winckel's *Diseases of Women*, p. 598. Pozzi saw one case that had been mistaken for an ovarian cyst. An exploratory puncture was made, and the patient died of embolus three days later. Terrillon is cited by Pozzi as removing a lipoma springing from the mesentery and weighing 60 pounds. Winckel quotes Pernice, who extirpated one weighing 30 pounds from the right broad ligament; his patient, aged sixty-four years, recovered. Winckel also gives credit to Klob and Orth as having seen similar cases. After quoting Rokitansky, who observed a lipoma the size of a walnut on the lower border of the tube in a woman aged forty-seven years, Winckel dismisses the subject by saying that " lipomata have no practical significance because of their small size."

The *clinical character, symptoms* and *diagnosis* of solid tumours of the broad ligament are much the same as those produced by the cystomata of this region. They are of slow growth, not tender to the touch, and are with or without pedicle. When pedunculated, as in Dr. Schmid's case, they extend freely into the general peritoneal cavity and admit of comparatively easy removal; when there is no pedicle, the tumour develops subperitoneally, spreading the folds of the broad ligament apart and forcing the uterus to one or the other side. Like some of the parovarian cysts, these tumours may dissect up the parietal peritoneum anteriorly or posteriorly or both, and thus present great difficulties during efforts at their removal. The *diagnosis* is by no means easily made, and, so far as Zinke is able to determine, in the great majority of the cases observed, it is arrived at only after the abdomen has been opened. This, too, is his own individual experience with these cases.

The *treatment* of the solid but benign tumours of the broad ligament may be conveniently divided into palliative and curative. Both methods of procedure are much the same as those in vogue for uterine fibroma and myoma, and the reader is referred for the details of descrip-

tion to the chapter on this subject in this work. Suffice it to state here, that the use of ergot, hydrastis canadensis, and electricity, have been well tried by good, earnest, well-trained men. The results are anything but satisfactory so far as a cure or decided relief is concerned. Apostoli, Keith, Engelmann, and many other able and painstaking investigators of the value of electricity in these cases, have been disappointed in the results obtained, and it is pretty generally believed that the so-called " cures " accomplished, about 2.4 per cent of many hundreds of cases, represent the possible percentage of errors in diagnosis (*American Text-book of Gynecology*, p. 401). Unfortunately, the result obtained with ergot, hydrastis canadensis, and iodide of potassium, hypodermatically or *per os*, is not much better. Zinke, for a number of years, has given these remedies a faithful and extensive trial, even after spending a month with Apostoli in Paris and many years of association as pupil and assistant to C. D. Palmer, who was, and to some extent still is, a firm believer in and ardent advocate of these methods of treatment. If there is any doubt as to the value of any of these means in the treatment of uterine fibroma and myoma, it would seem that the outlook is not very encouraging with the same measures in the treatment of intraligamentary fibromyomata. There appears to be no record of the application of the above treatment in lipomata of the broad ligament.

The only true remedy is removal of the tumour or tumours by enucleation through the abdomen; although Péan, and a few others who have followed his method of *morcellement*, have done so successfully, by accident rather than otherwise, by the vaginal route.

According to Olshausen the credit of first presenting and recommending the essential features of the present mode of enucleating these growths belongs to Miner, of Boston (1869). The operation of enucleation is not a very difficult one if the tumour is not large, and has grown toward the abdominal cavity rather than into the pelvis; but when excessive in size, both the abdominal and pelvic cavities will be occupied by the tumour. Again a tumour or tumours of but moderate dimensions may be so situated in the pelvis as to fill it out completely, thus displacing the pelvic viscera upward in every direction; in addition to this, there may be numerous adhesions and other complicating diseases, which will make the operation very difficult and formidable. Martin, Hegar, Kaltenbach, Olshausen, Kelly, Baldy, and many others, have clearly described how to proceed under the various conditions that may present themselves. The principal object to be attained is to avoid hemorrhage and injury to other structures as much as possible. The ureters, bladder, and the large blood vessels within the pelvis, are especially endangered when the growth is very large or confined to the pelvis, and the adhesions numerous and firm. Pedunculated, solid, intraligamentary tumours, are very rare. Their removal is simple enough. The stitching up of the cavity left by the peritoneal folds after enucleation of the tumour is no longer prac-

tised. Where the folds fall into apposition, there is no need for sewing; where they remain separate, experience has shown that recovery is much more prompt when, after arrest of hemorrhage, the cavity is simply cleaned and the abdominal wound closed without drainage. Martin, Hegar, and Kaltenbach recommended drainage into the vagina. Greig Smith, Goodell, and Skene were the first to abandon it. At present, drainage in these cases is, with most operators, a thing of the past. We doubt whether Senn, who recommended vaginal drainage in his book on tumours (1895), still practises what he then taught. Olshausen (1886) does not approve of supravaginal hysterectomy in all these cases, as has been advocated by Reuss, Goffe, Schenk, Braun, Kelly, Hall, and others. Olshausen believes that this procedure simply complicates and prolongs the operation, and should not be resorted to unless there is an absolute necessity for it. (See Treatment of Parovarian Cysts.)

Dermoid tumours of the broad ligament may develop from the underlying connective tissue. Quervain (*Archiv für klinische Chirurgie*, Bd. lvii, H. 1), in mentioning this fact, alludes to 15 cases of dermoid tumours developing from the pelvic connective tissue. The symptoms in such cases are due to pressure. Dermoids in front of the rectum may simulate tumours of the cul-de-sac, those behind it cold abscesses or serous or hydatid cysts. Exploratory puncture, though not free from danger, may be necessary for diagnosis, but when that is established it is better to operate as soon as possible. The method of operation depends on the situation of the dermoid; perineotomy is indicated if the tumour extends downward, the juxtasacral incision if it is high up, and either of these methods may, if necessary, be combined with the extraperitoneal abdominal. If discovered during labour, the tumour may be incised and drained, but should be extirpated as soon as possible after delivery.

Solid tumours of the round ligament are occasionally encountered. They are rarely very large, and may develop either from the outer extremity of the ligament, when the neoplasm becomes extraperitoneal, or, more properly, properitoneal; or they may develop within the peritoneal cavity, when they may be properly designated intrapelvic.

Weber (*Société d'Obstétrique et de gynécologie de St. Petersbourg*) has reported 3 interesting cases of tumours of the round ligament. In one, the tumour extended from the inguinal canal into the labium majus. The growth was solid in character, containing a few small cavities filled with fluid; and was pronounced to be a lymphangeiectoid fibroma. In another of his cases, a myoma originating in the round ligament had developed within the abdominal wall. In his third case, a fibromyoma was discovered inside the peritoneal cavity, in the course of an operation for hernia.

The *treatment* of these cases is necessarily by operation. In the properitoneal variety, the tumour is exposed by a long vertical inci-

sion, crossing obliquely the crural arch. Care is then taken to search for the portion of the tumour which lies in contact with, and occupies, the inguinal canal. If necessary, the inguinal canal itself should be opened by free incision, the dissection being carried far enough upward to enable the operator to enucleate the tumour, precisely as if it were a growth of the abdominal wall. When the tumour is intrapelvic, it is liable to be mistaken for one of ovarian origin. The operation, under such circumstances, is precisely like an ovariotomy, with the exception that the pedicle should be differently treated. It is to be remembered that, in cutting away the tumour, a segment of the round ligament is likewise being removed. This deprives the uterus of one of its anterior guy ropes, a defect which, if possible, should be remedied at the time. This may be accomplished by transfixing the two cut ends of the round ligament by means of a ligature and bringing them together, the approximation being strengthened by a fold of the peritoneum, held in position by another transfixing but continuous suture. When these tumours are large, they sometimes cause backward displacement of the uterus, which should be remedied at the time of operation.

Fibromyomatous tumours of the round ligament are very rare. They generally develop in the extraperitoneal segment. Delbet and Heresco (*Revue de chirurgie*), in 16 cases of these tumours, found but 4 developing from the intra-abdominal portion of the ligament. Claisse accounts for their relatively greater extraperitoneal development on the theory that that segment of the cord is more liable than the intra-abdominal portion to repeated, although probably slight, traumatisms. They grow to various sizes. Kleinwachter had a case in which the tumour developed 2.5 centimetres from the uterus and weighed 1,750 grammes. Matthews Duncan reported one the size of a hen's egg; Winckel, one the size of a bean. In Delbet's case, the tumour weighed 5 kilogrammes. In Segond's case, the growth in the ligament was associated with numerous similar growths in the uterus itself. Like the latter, they occur for the most part in women of middle or advanced life, and are as liable to develop upon one side as upon the other. In their structural origin and evolution, they are analogous to fibromyomata of the uterus, although their manner of growth seems to be by perivascular inflammatory proliferation.

Pelvic varicocele, aneurismal varix, and **phleboliths,** may be considered under one head. Varicocele of the broad ligament is probably not as uncommon as is supposed. There are but few operators of long and extensive experience who do not come, accidentally, across cases of this kind in their abdominal and gynecological work; yet we find the literature upon this subject exceedingly meagre. The first case reported in this country was that of Dr. Dwight, of Boston, in 1877, quoted by A. P. Dudley, who, so far as Zinke is able to determine, wrote first in this country exhaustively on Varicocele in the Female and reported 4 cases (*New York Medical Journal*, 1888, p. 147). Winckel found dilatation of the utero-ovarian veins not less than 10

times out of 300 autopsies. He also found thrombi. Both Klob and Bandl have found phleboliths (Pozzi). Dudley also quotes Brandt as having often seen stones, the size of peas, in the veins of the broad ligament. Rousan (*Thèse de Paris*, 1892; Bagot, *Denver Medical Times*) states that pelvic varicocele is of frequent occurrence. Edward Malins, of Birmingham (*American Journal of the Medical Sciences*, 1889, p. 340), writes interestingly upon Varicose Veins of the Broad Ligaments, and reports 2 cases. To this, Zinke adds 2 cases: one, an aneurismal varix of the right, and the other a phlebolith within the left, broad ligament. In the former case, an abdominal section was successfully performed for the relief of uterine hemorrhage induced by varicose conditions in the right broad ligament. This condition was in turn brought on by previous labours and was aggravated by a laterally flexed uterus in the fourth month of gestation.

In the second case a bilateral salpingo-oöphorectomy and myomectomy resulted in the discovery of a phlebolith 4.5 centimetres long, 1 centimetre thick in the centre, and tapering off toward each end, in the left broad ligament quite close to the uterus.

The *causes of varicocele* and aneurismal varix of the broad ligament are, to say the least, quite obscure. Dudley in this country, Malins in England, and Winckel in Germany are about the only authors who have essayed to ascertain the etiological factors of this affection. Dudley divides the causes into, (*a*) *constitutional*, and (*b*) *mechanical*. Malins into *general* and *local*, which is practically the same.

(*a*) *Constitutional* or *general*: Arrest of involution of the uterine and ovarian vessels, keeping up pelvic engorgement long after confinement. A relaxed condition of the tissues from a low state of general health. An unhealthy condition of the vessel walls. An absence of valves in the veins.

(*b*) *Mechanical* or *local*: The anatomical relations of the veins themselves; the spermatic and ovarian vessels being of such great length that the weight of such a column of blood has a tendency to weaken the vessels. Habitual constipation. Uterine displacement.

As a reason why the left broad ligament is the more frequently affected, Dudley states: The emptying of the venous blood from the left broad ligament into the left renal vein is at right angles to the blood current from the kidney, and it obstructs the free flow of the blood from the ligament into the general circulation.

Janni (Congress of Italian Surgeons, October, 1898) asserts that varicocele is not due to the retrogressive changes of the venous walls, conditional upon their expansion; but, frequently, to neoplasms of the elastic connective tissue of the intima, which assumes the form of an actual endophlebitis in knots or plaques, and is often accompanied by neoplasms of the connective tissue of the median vein. These neoplasms have not the compensatory character ascribed to them by Eckstein (*Cincinnati Lancet-Clinic*, April 1, 1899).

Zinke believes the causes just cited to be without objection; but thinks that intra-abdominal pressure from any cause should be added to the list, and that for the formation of an aneurismal varix in this region, direct or indirect traumatism is necessary, as, for instance, external violence, frequent application of the forceps during labour, repeated abortion, operations upon the cervix, and diseases of pelvic organs. Phleboliths result from calcareous degeneration of thrombi.

The *history* and *symptoms* of these cases, as Dudley correctly remarks, are those of varicocele in the male. The pain is of a heavy, dull, aching character, most marked and much increased when the subject remains long in the erect posture; and correspondingly lessened, and even followed by almost complete relief, when she is in the recumbent position for a long time. There may be a history of traumatism, malaise, nervousness, general indisposition, and even of melancholia. Frequent and profuse menstruation, or even metrorrhagia, in women past the menopause may be observed (Zinke).

The *diagnosis of varicocele* must of necessity be very difficult and uncertain, if at all possible, even in well-marked cases. Varicosities and vein stones are, as a rule, recognised only when the abdomen is opened on account of other pathologic processes. The same may be said of aneurismal varix when not very large; otherwise it may give rise, as in Zinke's case, not only to a palpable, pulsating tumour, but to serious hemorrhages from the uterus, especially when complicated with pregnancy. Under certain favourable conditions, however, a diagnosis does not seem impossible in connection with the symptoms given. When limited to the broad ligament and free from thrombi, the knotted swelling felt with the patient in the upright posture, will be absent when the patient lies down, and only a doughy, thickened condition, will present itself to the finger in the vagina or rectum. If thrombi are present, the knotted condition will continue to exist, more or less. At all events, we must never be too sure of our diagnosis.

But little can be said as to the *course* and *treatment* of these cases. One or all of the three conditions may exist to some extent for a considerable period, and, perhaps, for a lifetime, and not give rise to any symptom whatever; or complications may be present obscuring the varix entirely. If discovered during an operation, the operator must determine as to what should be done for the relief or cure of the patient. Up to the present time, the experience of all writers and operators is very limited. Zinke has occasionally removed varicosities together with diseased ovaries and tubes; and when, as happened in one of his cases, the varix existed in the broad ligament alone and uncomplicated, he did not interfere, which he now believes was a mistake. Nor did it appear wise to him to attempt the removal of the aneurismal varix mentioned above, because of the existing pregnancy and the injury done to the uterus by the sac forceps. It is,

however, more than likely that, should another or similar case present itself to him in the future, he would dispose of the evil in the manner pursued by Dudley, of New York, who operated upon 4 cases. In case No. 1, he was able to remove the varix with the ovary and tube, just as Zinke did in his three instances. In cases No. 2 and 3, Dudley quilted both broad ligaments close to the pelvic floor. All his cases recovered promptly, perfectly, and permanently, and he advocates radical treatment as the only means to do good. Bleeding by leeching or puncturing the cervix; the daily use of irrigation with hot water; the tampon, a well-adjusted Hodge's pessary, and other local applications as recommended by Malins before removal of the varicocele is resorted to, will always remain palliative, not curative treatment. It is also doubtful whether the mere removal of the ovaries and tubes will invariably produce good results.

Reed operates upon varicocele of the pampiniform plexus by interrupted ligatures inserted at short intervals by means of a long-handled, curved needle (Fig. 295), and incision of the veins between

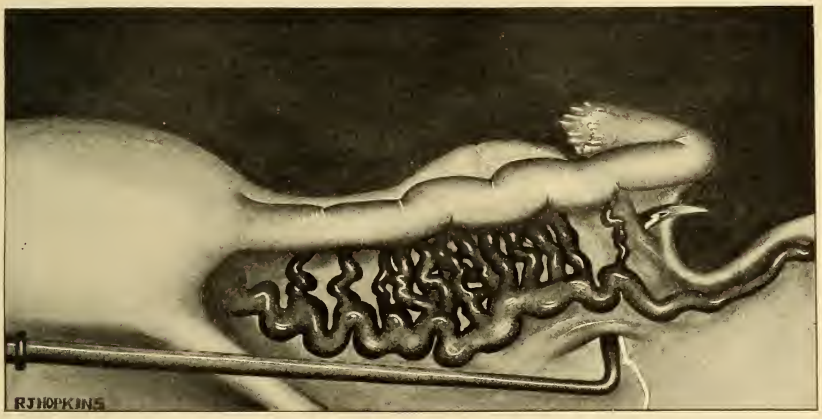

Fig. 295.—"Interrupted ligatures inserted at short intervals by means of a long-handled curved needle."

the ligatures. This operation is applicable only when there exists no indication for the extirpation of the uterine appendages. Under the latter circumstances, the hemostatic ligatures should be made carefully to embrace the veins as well as the arteries, the veins being divided between the ligatures. Division of the veins is essential to the permanent success of the operation, as shown in Fig. 296, in which one section of the ligated veins has not yet been incised.

The *influence* of the varix in the broad ligament upon the ovary manifests itself, according to the histological researches of Paul Petit, in two distinct phases; one of engorgement, which renders the ovary œdematous and, later, hypertrophied; and one of sclerosis, terminating in atrophy.

Malignant Neoplasms: Carcinoma and Sarcoma of the Broad Ligament.—When the broad ligament becomes the site of malignant disease it is, so far as we now know, of secondary origin; in other words, it is the result of a primary affection of the uterus, vagina, ovary, or peritoneum. According to Pozzi, "Bandl has seen some cases where they came from the pelvic ganglia." To what extent the broad ligament may become involved, is best illustrated in a case related by

FIG. 296.—"Division of the veins is essential to the permanent success of the operation" (page 685).

Howard A. Kelly in his work on *Operative Gynecology*, vol. ii, p. 331, wherein he says he found it "impossible to extirpate the disease in the broad ligaments and to check the free oozing from the diseased tissue which was cut; in order, therefore, to control the entire blood supply going to the part, I ligated both internal iliac arteries at a point 1 centimetre below the bifurcation of the common iliacs." Winckel refers to Chénieux, Duplay, Gortier and Hages, who have reported operations upon sarcomata of the broad ligament.

An involvement of the broad ligament in cancerous diseases of the uterus and ovary is not rare; it is not so frequent when the bladder or vagina is the site of the primary growth. Zinke is of opinion that when the disease springs from the uterus and involves the vagina and broad ligament to but a limited extent, the total ablation of the diseased organs, glands, and tissues, through the abdomen will, in some cases, insure permanent relief. Zinke has 2 cases on record in both of which he performed total hysterectomy *per vaginam* eight years ago. Both patients are still living and in excellent health. One was fifty years old, and the victim of an epithelioma starting in the cervix and implicating by extension the corpus uteri, vaginal roof, and both broad ligaments. The operation was performed at the German Hospital, March 28, 1892. The other patient, aged forty-six years, had a sarcoma of the body of the uterus extending into both ligaments to a marked degree, but not sufficiently to cause uterine fixation. The

operation was performed on February 22, 1892, at the patient's home. Zinke now prefers the abdominal route in all cases showing involvement of the uterine ligaments. Though both the foregoing cases were attended by excellent results, he feels that the operation can be done with much more ease and thoroughness by going in from above.

CHAPTER XLIV

INFECTIONS OF THE BROAD LIGAMENT AND OF THE PELVIC PERITONEUM

Infections of the broad ligament—Pyogenic—Pelvic abscess; treatment—Syphilitic—Parasitic—Tuberculous—Tuberculous peritonitis, etiology, morbid anatomy, miliary, caseous, fibroid, symptoms, diagnosis, prognosis, and treatment.

Infections of the broad ligament may result from invasion by various micro-organisms, which may migrate thither from various points of entrance into the system, and through different highways of communication. Thus, the streptococci finding their original point of entrance in an infection atrium of the parturient uterus, reach the broad ligaments and the structures contained therein through the avenue of the lymphatics. The same may be said of the *Bacillus aerogenes capsulatus*, the staphylococci, and the toxine of syphilis, when the uterus is the site of the primary sore. On the other hand, it is exceedingly probable that the gonococcus, so fruitful of mischief upon the mucous surfaces, rarely if ever extends its ravages to the subperitoneal structures, although it is a frequent cause of inflammation originating in the peritoneal side of the broad ligament. Echinococcous infection probably travels through the circulation, or else by direct invasion of cellular areas. It is probable that the colon bacillus reaches this locus by direct invasion of intervening structures.

The *pathology* of infections of the broad ligament depends somewhat upon the micro-organism or other causative infectious element, and upon its avenue of ingress. When the lymphatic system is the highway of invasion, the resultant phenomena may be, in the case of less virulent bacteria or toxines, nothing more than an acute nonsuppurative lymphangeitis (pelvic lymphangeitis); or, in the presence of more virulent elements, suppuration may ensue; while, as the result of chronic infection of syphilitic origin, there may result that form of hyperplasia of the lymphatics, known as gummata.

Pyogenic infections depend chiefly upon (*a*) the streptococcus, (*b*) *Bacillus coli communis*, (*c*) the staphylococcus, and (*d*) the *Bacillus aerogenes capsulatus*. As elsewhere intimated, gonococci seldom play a part in the production of suppuration in this locality. It is unnecessary in this connection to attempt to distinguish clinically between these various forms of infection. A conclusion on this point may be reached

by studying the general features of a given case, as, for instance, in puerperal fever; for, as a rule, infection within the broad ligament is only a part of the clinical and pathologic picture.

Pelvic Abscess.—*Suppuration* in this locality may begin at multiple foci, or it may radiate from a common centre. It may be so circumscribed as to defy detection by bimanual examination, or it may be so extensive as to lift up and separate the folds of the broad ligament and of the parietal peritoneum; such an accumulation of pus constitutes a tumour, upon the surface of which may be seen the tensely stretched Fallopian tube and the ovary, both uninfected. These are cases of true *pelvic abscess.*

The *treatment of pelvic abscess* is by evacuation and drainage. This may be accomplished in various ways, the method to be selected depending somewhat upon the location of the pus sac. If careful bimanual examination indicates that the accumulation of pus has extended forward and lifted up the anterior fold of the broad ligament, and has thus resolved itself into an essentially properitoneal abscess, an inguinal incision may be made. This should be done by making a careful dissection down to the upper margin of Poupart's ligament, after which the peritoneum can be lifted up and the abscess cavity be thus reached without opening the peritoneum. If desired, through-and-through drainage may be practised by making a counter opening in the fornix of the vagina and passing a tube through the external opening into and through the vagina. (See Fig. 231.) If the accumulation has burrowed far down along the vagina, vaginal puncture may be practised, as elsewhere described (see Fig. 225), and permanent drainage may be established, either by the introduction of a self-retaining tube, or by the use of gauze. (See Infections of the Fallopian Tubes.) The operation formerly adopted by Tait, of making a median abdominal incision and stitching the wall of the abscess to the margins of the abdominal wound and draining in that way, may still be an operation of choice in exceptional cases. It, however, uniformly results in the formation of peritoneal adhesions, which must necessarily be the source of subsequent pain, and is, therefore, not to be employed under ordinary circumstances. Zuckerkandl operated upon these cases by placing the patient upon the side and making an incision obliquely on the affected side in the sacrococcygeal region. This becomes an available expedient in those cases in which the suppuration has extended behind the rectum and presents a fluctuating point in the postrenal region. It happens occasionally that pus burrows almost or quite to the vulva, under which circumstances an incision may be made vertically, a little to one side of the vulvoperineal region and about 4 centimetres long. The dissection should be carried up until the levator muscle is exposed, which should be pushed to one side, when the abscess cavity can be easily reached. This is the procedure adopted by Sänger, which has been modified by Zuckerkandl, who makes a transverse perineal incision in cases in which the purulent accumulation occu-

pies both sides of the vagina. Rectal puncture has been practised by different operators, but while it is a convenient method of reaching the pus cavity in certain of these cases, it is always liable to leave a sinus which is difficult to control.

Syphilitic infection, manifesting itself in the structures beneath the broad ligaments, is necessarily secondary to a primary sore of the uterus, or the upper portion of the vagina. If the primary chancre is located in the lower portion of the vagina, or upon the vulvar structures, the superficial lymphatics are the first to be involved, the secondary disturbance manifesting itself in the inguinal glands. Lymphangeiitis of syphilitic origin may be manifested, although rarely, in the lymph channels themselves, or, as is most generally the case, in the lymphatic glands (lymphadenitis). The lymphatic vessels may become acutely inflamed and subsequently indurated, exhibiting the characteristics of tense, sensitive cords, within the more or less diffusely infiltrated connective tissue. Inflammation of the intrapelvic lymphatics occurs after the first or second week of an initial infection. Invasion of these glands is associated with fever, and with tenderness and enlargement of the glands themselves. They may reach the size of a hazelnut or a walnut, and they may or may not become the seat of suppuration. As a rule, however, the tenderness subsides after a few days, leaving the glands enlarged and but slightly sensitive to the touch. This enlargement, associated with but slight sensitiveness on touch, may persist from a few weeks to several years. In the irritative stage, there are marked hyperæmia, increased flow of serum, and enlargement of cells. The enlarged follicles of the gland present the appearance of grayish-white dots; with the recession of the circulatory engorgement, there occurs connective-tissue proliferation, and newly proliferated tissue elements show a marked tendency to become definitely organized, a fact which accounts for the persistence of glandular enlargement in these localities. In some instances, however, cell proliferation progresses to such a degree that the newly formed elements can not be sustained by the blood supply, and then retrogressive changes are inaugurated. This may take the form of either a cell necrosis eventuating in what Virchow designated caseous metamorphosis, or of suppuration. In still other cases enormous gummata the size of a man's fist, may develop. These may be mistaken for fibroids of the uterus, or other fibromyomatous growths of intrapelvic origin. Reed has seen two cases of this kind, in which the exact character of the enlargement was demonstrated. The diagnosis of syphilitic infections of the broad ligament is based chiefly upon an antecedent syphilitic history. The treatment is by that course of medication which is conveniently designated under the title antisyphilitic. In cases of large gummata, the latter may be removed, according to their exact location, by either abdominal or vaginal section.

Parasitic infection of the broad ligaments is chiefly restricted to invasion by the echinococcus. It is well known that the echinococcous disease may attack any organ in the body, and it seems, according to

W. A. Freund, Wiener, and others, that the broad ligament constitutes no exception. It is asserted (Pozzi) that the echinococci " travel about in all the cellular interstices communicating with the superior pelvirectal space, which seems to be their point of entrance, and may thus reach the broad ligament, pass into the iliac fossa, and out of the pelvis either below or above the crural arch." Freund reported 18 cases of echinococcus within the pelvis to the gynecological section of the Fifty-first Meeting of German Naturalists and Physicians at Baden, 1880. In 10 of the cases the diagnosis was proved by section, and in the rest, by puncture and operation respectively. It was Freund, too, who determined the site of the echinococcus in the pelvis, the road it travels, how it grows, its relations to the intestines, its spontaneous existence if left to itself, how to make the diagnosis, and the treatment to be pursued (*Archiv für Gynäkologie*, Bd. xv, 1880).

In addition to the *symptoms* of the presence of a pelvic tumour or tumours, we shall have the symptoms characteristic of echinococcus; if the patient's health is good, as it often is, vocation, association with dogs (especially shepherd dogs), and country, will aid us in our diagnosis. The hydatids often cause inflammation of the pelvic organs and adhesions between them. The cysts which form vary considerably in size; some may grow so large as to demand removal through the abdominal wall. When the inflammation is extensive, the disease may be mistaken for cancer. The cysts are filled, as a rule, with a clear fluid, nonalbuminous in character, and containing chlorides and sometimes traces of sugar (Osler). Suppuration may occur, especially when hooklets are found; when they are absent, it is believed that the fluid is sterile and the cyst becomes harmless.

Medical *treatment* of these cases is not very satisfactory. The cysts, if they become troublesome, may be attacked through the vagina, perineum, juxtasacral region or the abdominal wall. All will depend upon the location and size of the cyst. The sac may be completely enucleated or stitched to the wound and then drained. Freund (Pozzi) says: " If we have to cut through the peritoneum we must, so soon as we reach the sac and before opening it, use a tamponade of iodoform gauze for twenty-four or forty-eight hours, in order to assure hematemesis, and the formation of protective adhesions; at a second *séance* we can open the sac under antiseptic precautions."

Tuberculous infection of the broad ligament may be manifested in either the peritoneum (tuberculous peritonitis) or, in the underlying lymphatics. Tuberculous infection of the pelvic lymphatics rarely exists as an independent manifestation of the disease, but, on the contrary, is but a local manifestation of a general involvement of the lymphatic system. Lymphadenomata of tuberculous origin rarely attain the size of those due to syphilitic infection. They are equally chronic in their manifestations.

Tuberculous infection of the peritoneal folds of the broad ligament probably never exists, except as a part of the general tuberculous

infection of the peritoneum. In view of the fact, however, that the reverse proposition is equally true, there may be no impropriety in considering tuberculous peritonitis in this connection.

Tuberculous Peritonitis.—Tuberculosis of the peritoneal cavity is one of the most important conditions that the gynecologist is called upon to treat. The disease is characterized by the development of minute miliary tubercles over limited or extensive areas of the peritoneum, by ascites, by tumour formation, and by the development of caseous abscesses.

Etiology.—The cause in all cases is the invasion of the peritoneal cavity by the tubercle bacillus. The method of this invasion is at times difficult to determine, and certainly varies in different cases. The infection may take place from the blood in a very few cases. An infection through the female genital tract has been found by Williams to occur in from 40 to 50 per cent of the cases, a fact which likewise has support in the greater frequency of tuberculous peritonitis in women than in men (Sippel). The female genital organs seem to afford an easy portal of entrance. Abbé has demonstrated that 66 per cent of the cases are infected from tuberculous thoracic lymph nodes, and 16 per cent through the mesenteric lymph nodes. The alimentary canal, certainly, may be the source of infection, since it has been well demonstrated that the tuberculous sputum or fragments of tuberculous lung (as used in animal experimentation) may cause an intestinal or a peritoneal tuberculosis (Klebs, Mosler, Jans).

A previously depressed state of health does not seem to be a predisposing factor, since the majority of these cases look well nourished in the early stages of the disease, and have previously been in good health. Pregnancy shows a definite causal relationship which has not been adequately noted (Kelly).

The *age* of the patient likewise seems to be a predisposing factor, since the collected cases of Osler show that the greater number occur between the ages of twenty and thirty, and that the two extremes of age are relatively immune. In regard to *race*, it has been shown that the negro is more frequently affected than the white. Hereditary transmission of the disease has been observed to be an important etiological factor. Brunn has observed such transmission in 55 per cent of his cases, Brehmer in 40 per cent, Desplans in 71 per cent, and Fuller in 60 per cent. A peculiar feature of the disease is the uncommon occurrence of grave tuberculous lesions in other parts of the body. Schröder states that it is a local phenomenon in 70.8 per cent of cases. The presence of a tuberculous peritonitis would seem to afford an immunity to tuberculosis elsewhere (Kelly).

Morbid Anatomy.—The lesions of tuberculous peritonitis show decided variation in their manifestation, and permit of an indistinct division into a miliary, a caseous, and a fibroid variety. The *miliary form* may appear and exist for a long time without giving the slightest symptoms. On opening the abdomen for other reasons, the

peritoneum of the pelvis or the entire peritoneal cavity is found to be peppered with minute miliary tubercles. The other appearances will vary greatly with the acuteness of the attack, the formation of adhesions, etc. In an acute miliary tuberculosis, the peritoneum is noticeably congested and thickened, has lost its normal lustre, and shows fresh lymph on the inflamed surfaces. The fluid in the peritoneal cavity is yellow or bloody, and may be encysted by adhesions or free in the general cavity. The adhesions of the intestines to each other, or of the omentum, are not usually extensive because of the tendency to effusion, and they are usually frail and bleed easily.

The *caseous variety* is characterized by a much more profound anatomical disturbance, by tumour formation, caseous abscesses, and severe interference with the functions of the intestine. In the most severe cases, the peritoneum throughout is the seat of a caseous tuberculosis, all structures are agglutinated by the tuberculous pseudomembrane, and the entire mass of intestine may form a firm tumour which is retracted against the spinal column. A variable number of encysted accumulations of yellowish caseous or purulent fluid may be included in the tumour mass.

It is the rule, however, to find the disease more localized in the region of the pelvis, the cæcum, the omentum or the liver. Under these conditions, the intestines adhere lightly or firmly together and may wall off the exudates in a more or less distinct sac which represents the entire lesion, or a general ascites may coexist. Such a sac may be mistaken for a cyst. This error may be avoided by observing (1) the fine white lines which mark the point of agglutination of the intestine by lymph and run parallel to it, and (2) a faint vermicular motion after a sharp blow with the finger. If such collections become purulent, they may lead to ulceration and intervisceral or external fistulæ or they may burrow extensively.

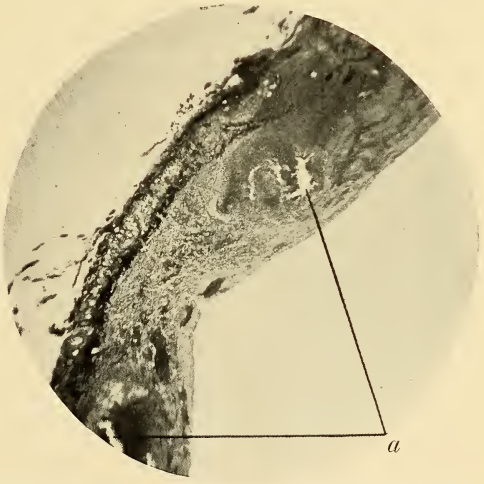

Fig. 297.—"When the disease is localized in the omentum, this organ becomes greatly thickened." *a*, Typical round-celled miliary tubercles.—Whitacre.

When the disease is localized in the omentum (Fig. 297), this organ becomes greatly thickened, but at the same time puckered and rolled up to form a firm, elongated tumour lying transversely across the upper part of the abdomen. This tumour may subsequently caseate and

ulcerate either externally or into the intestine, but such a termination is extremely rare.

Pelvic tuberculous peritonitis is generally associated with tubal tuberculosis and in this type of the disease is generally represented by cystic formation and extensive binding down of all pelvic structures into one hard mass. The cyst may extend well above the pubes, and the entire pelvis is covered in by a thick, friable, grayish, tuberculous membrane, which is likewise adherent to the intestine above. The pelvic peritoneum is certainly the most frequent seat of tuberculous peritonitis, and this fact has been explained by Weigert, who has demonstrated that the tubercle bacilli always fall to the bottom of the peritoneal cavity.

The *fibroid type* of tuberculous peritonitis is in reality a terminal stage of the preceding varieties, more especially the first. The miliary tubercles are found in a quiescent stage with few cellular elements and very few bacilli, while old adhesions and tuberculous masses have almost entirely lost their tuberculous nature, and have been converted into firm fibrous tissue.

Symptoms.—It will be seen from a study of the lesions of tuberculous peritonitis that the symptoms may be entirely absent, or may possess all the severity of an extensive inflammation of the peritoneum, and be associated with those of intestinal obstruction.

Certain indefinite prodromata, such as loss of appetite, loss of flesh, digestive disturbance, or an afternoon fever, may be present, but many cases begin as a sudden attack of acute peritonitis with a temperature as high as 103° F., acute abdominal pain, tenderness, and ascites. These symptoms subside after a few days and the patient continues with a persistent digestive disturbance, indefinite pains, an afternoon rise of temperature and some tenderness. The most constant symptom of the slower form of onset is *pain* referred to the lower abdomen and pelvic organs, and associated with menstrual disturbance. This pain varies all the way from a continuous ache to a most intense suffering that confines the patient to bed (Kelly). It is described as a bearing-down pain, as shooting pains, or by the negro as a "misery." The pain is usually associated with *tenderness* over the lower abdomen.

Swelling of the abdomen and a sense of "bloating," are also fairly constant features, dependent at first almost entirely upon tympanites, but, later, ascites adds to the swelling. This is usually associated with loss of appetite, dyspeptic symptoms and constipation.

Fever is a marked symptom in the acute cases and fairly constant as an afternoon rise in the more chronic forms. In the latter it reaches 99° to 100° F. and the patient complains of having "malaria" or "chills and fever."

Pain in urination is given by Kelly as the most characteristic of all the symptoms.

Berggrün and Katz have found that an abundance of fat in the

stools of infants is a valuable diagnostic point. They state that, while the bile is fully secreted and acts normally to prevent putrefaction, the work of fat digestion is imperfectly done.

A striking peculiarity of the condition is the frequent occurrence of an abdominal tumour. These tumours are omental, the result of sacculated collections of fluid, are made up of adherent masses of intestine that have become thickened and retracted, or they are formed by enlarged mesenteric glands, especially in children. They give the most confusing physical signs that are ever encountered in abdominal surgery, yet their very anomalous nature has come to be looked upon as one of the diagnostic features of peritoneal tuberculosis. An apparently solid tumour will give tympanitic resonance, the confines and the relations of the tumour will often change between two examinations, tympanitic resonance will persist in the flanks in the presence of a considerable effusion because of the encysted condition of the fluid, and, finally, such tumours of the uterine appendages or in the region of the cæcum may simulate those of pyogenic origin.

Diagnosis.—The diagnosis of this condition presents many difficulties, since the signs that are characteristic of tuberculosis in other parts of the body fail us here, and it is a well-established fact that many cases of tuberculous peritonitis are not diagnosticated before operation. Nevertheless, experience has taught us that a diagnosis may usually be made with certainty (*a*) when the abdominal condition is associated with extensive pulmonary disease; (*b*) when tubercle bacilli are found in the uterine secretions or curettings, and (*c*) when an anomalous mass of slow formation is found in the pelvis and is associated with an ill-defined fluctuating tumour of the lower abdomen that changes its relations from time to time.

Bulius has called attention to the diagnostic value of tuberculous nodules in the pelvic peritoneum. These vary in size from that of a millet seed to that of a bean, and may often be distinctly felt on the broad ligament, the Fallopian tube, the lateral wall of the pelvis or on the posterior surface of the uterus when this organ is pulled down by a volsella and examined *per rectum*. The sensation is that of a grater. The other conditions in which such nodules may be encountered are metastatic carcinoma, papillary cystoma of the ovary, and the small blisters of certain forms of peritonitis. Edebohls has placed positive diagnostic value on a plaquelike thickening of the peritoneum. The exclusion of abortion or gonorrhœa in the presence of a lateral mass will make a diagnosis of tuberculosis probable (Morris), but it must be remembered that abortion sometimes acts as a predisposing factor in tuberculous peritonitis. The simultaneous occurrence of pleurisy with effusion, especially when this fluid is bloody, is a very important diagnostic sign. A careful personal and family history of the case should never be omitted since heredity, the history of previous attacks of peritonitis, the history of "chills and fever," a gradual increase in the swelling, a more or less constant pain increased in walking, an

uncertain percussion note, and loss of flesh, are among the most important clinical diagnostic points.

Finally, the diagnosis has been made absolutely certain, according to some authorities, by the use of tuberculin. If no reaction takes place, the tuberculous character of the peritonitis is excluded.

It must be remembered that the tubercle bacilli are rarely found in the ascitic fluid. But they may be found in the uterine or vaginal secretions, or the ascitic fluid may be injected into the peritoneal cavity of guinea pigs.

The acute cases may be distinguished from typhoid fever by a previous history of abdominal pain, the absence of rose spots, the absence of diarrhœa and continuous fever, a distinct induration in the region of the cæcum, and the absence of the Widal reaction.

Osler states that of 96 cases, 30 were diagnosticated as ovarian disease. In the diagnosis between tuberculous peritonitis and ovarian cyst, we are guided by the history of antecedent disease of the appendages, the rapid development of an effusion, the ill-defined nature of the fluid tumour, a coincident pleurisy, the bacteriological examination of the uterine secretions, and by a most accurate bimanual examination made *per rectum* when the uterus is drawn down.

Prognosis.—The age of the patient, the advanced state of the disease, and the character of the operative treatment, will all determine the prognosis in tuberculous peritonitis. The cases that do well are those in patients of middle age who have a considerable effusion of fluid either free or sacculated; while the dry forms and those cases with extensive adhesions of the intestines are likely to do badly.

Treatment.—Osler has justly stated that a great many cases of tuberculous peritonitis recover spontaneously, but it must be remembered that errors of diagnosis form a constant factor in such cases, and that a diagnosis often can not be made without an abdominal section. Furthermore, the nontuberculous type of peritonitis described by Gusserow, and also by Henoch, as "peritonitis nodosa," which is identical in appearance with miliary tuberculosis of the peritoneum, must form a constant source of error in medical cases.

The treatment of tuberculous peritonitis is invariably by laparotomy, and no case should be abandoned as hopeless unless actually dying or in such feeble condition that the operation itself would be fatal. Simple incision and immediate closure of the wound without touching a single viscus, or the evacuation of the fluid, has resulted in a cure of the condition, but the indications of the individual case must be met and certain principles adhered to in the performance of these operations.

The operation should have for its object the removal, if possible, of the focus of the disease, the removal of serous or purulent exudate, and the release of dangerous or painful adhesions.

The length of the incision will vary with the amount of manipulation that is necessary within the abdominal cavity. The uterine ap-

pendages should be removed whenever they are involved, and the difficulties of the operation in the advanced type of the disease are certainly very great. All structures below the brim of the pelvis are bound together in one rigid, friable mass; enucleation of the tumour without rupture of the intestine requires the most painstaking care; and nothing short of a raw, uncovered condition of the pelvis can be left behind.

The fluid in the peritoneal cavity is either free and requiring no special effort for its removal, or it may be sacculated and require a careful tearing of adhesions for its relief. Single adhesions should be released, but when the intestines are bound together in one mass they should not be touched. Certain operators advise flushing the peritoneal cavity in every case and the thorough mopping out of every part of the fluid, while others would irrigate only the pus cavities. The question of drainage in these cases has been rather definitely settled in favour of the immediate closure of the abdomen, unless there are distinct pus sacs which demand drainage.

Many theories have been advanced with considerable sagacity to explain the manner of the healing after abdominal section, but we are still without a positive explanation. It was first thought that the cures were accounted for by the presence of a "nodular peritonitis" instead of the true tuberculous peritonitis, but a great number of cases are on record in which the diagnosis has been made from the tissues or fluid removed at operation, and a disappearance of the tuberculous process has been demonstrated at a later date by autopsy or by subsequent operation. The *removal of the exudate* was supposed to improve the peritoneal vitality and resorptive power by relieving the embarrassment to the blood and lymphatic circulation (Bumm); but this is inadequate, since the dry forms are also healed by operation and mere tapping does not often result in healing. The use of *antiseptics* (iodoform, mercuric bichloride, etc.), can not explain the good results, because the improvement is much more satisfactory when none are used. The modern surgeon has suggested that certain bacteria which develop a *toxine that is antagonistic* to the tubercle bacillus must gain entrance at the time of operation. The germicidal action of *air* and *sunlight* on the tubercle bacillus was suggested by Koch as an explanation, but it is apparent that such action is only momentary, that it can not possibly reach the deeper pouches of the peritoneum, and that lupus of the face would not exist in the presence of such an action. Warnecke first suggested *hyperæmia* of the peritoneum following handling, sponging, flushing, or the contact of air, as the healing factor, and others insist upon the antibacterial action of the exudate that is immediately poured out (Sippel, Satti). Hildebrandt has demonstrated on animals that a laparotomy can only have its full effect when, in the natural life history of the tuberculosis, the retrograde process has already set in; and he believes that the *assistance to healing* given by laparotomy is the result of a persistent venous hyperæmia.

The injection of sterile air by Nolen can have no value, while the explanation of Bumm and Buchner, of a healing by phagocytosis and alexine formation, may have some importance. It is probable that the combined action of a number of these agencies will explain the healing that takes place.

The percentage of cures following operation is placed by Parker Syms at about 30 per cent as a result of a comparison of statistics varying from 24 to 80 per cent. König reports 131 cases in which 24 per cent were healed for over two years, 65 per cent under two years, and 3 per cent died after operation. At any rate, laparotomy must be looked upon as a life-saving measure that will be necessary in a majority of cases and having only the very low mortality of 3 per cent. The operation is not contraindicated in slight involvement of the lung, but should not be done when an acute miliary tuberculosis is present.

CHAPTER XLV

MENSTRUATION

Normal menstruation—Time of appearance—Menstrual cycle—Quantity of discharge—Character of the discharge—The inducing cause of menstruation—The rôle of the uterus—The rôle of the Fallopian tubes—The rôle of the ovaries—The hygiene of menstruation.

Normal Menstruation.—If we say that *menstruation is a sanguineous flow from the genitals of woman, lasting four days at each recurrence, and appearing at regular intervals of twenty-eight days from the dawn of puberty until the child-bearing period has passed*, we have made a very fair definition; but every separate statement contained in it is subject to many exceptions.

For, in the first place, menstruation is not peculiar to woman. In her, to be sure, the function has risen to its highest; but, none the less, it is an inheritance, and she, in menstruating, is not unique. In a number of our domestic animals at the time of maximum sexual excitement, there is a very notable flow of mucus from the vulva, and this mucus is oftentimes loaded with anatomical elements, young cells, and a small amount of blood. Millikin has observed this tinge in the case of the cow and the mare, and it has been reported as present in the female dog and in a number of apes and monkeys.

Walter Heape (*Proceedings of the Royal Society*, No. 361) has given an excellent account of *Macacus rhesus*, an Indian monkey, which has a definite breeding season but menstruates with regularity through the whole year. At the menstrual period, macacus displays a certain congestion of the skin upon the abdomen, legs, and tail, and to these simian symptoms adds the strictly ladylike features of swelling and congestion of the nipples and vulva, and flushing of the face. At the same time, there is a discharge of viscid menstrual fluid, mostly white, but containing red corpuscles, uterine *débris*, stroma and epithelium. Menstruation in *Semnopithecus*, as observed by Mr. Heape, corresponds very closely to that in macacus.

Curiously comparable to this is menstruation among the lowest savages of southern Africa. James Stirton, in the *Glasgow Medical Journal*, supporting a contention that menstruation is a product of civilization, says that in the lowest tribes accessible to him he found menstruation to be very scanty and irregular, and always inaugurated by a prolonged mucous flow which never became highly sanguineous.

There appears to be a gradation leading us from dry mammalian rut to the rutting with discharge of the highly artificialized domestic animals, thence to the menstrual rut of the quadrumana, and thence to the highly sanguineous flux of the human female. It is a biologic fact that the higher mammals menstruate when in heat; it is no slander to say that woman is in heat when she menstruates. Confirmatory of this is the fact, often obscured by the self-control belonging to women of the highest and most refined type, that the beginning of a menstrual flow tallies with an acme of sexual desire, insomuch that considerations of modesty and convenience will not always deter them from absolute solicitation at the menstrual time.

Against the identity of menstruation and rutting it has been urged that menstruation continues with regularity through the year, whereas rutting is a phenomenon of some particular time of the year; and the fittest answer is that the females of those animals which have been most artificialized by domestication, tend to come in heat at regular intervals through the whole year, after the manner of women. The mare, for example, tends to come in heat every three weeks, and the female dog who escapes pregnancy will also develop a regular period. That is to say that, when living under human conditions, they tend to human menstruation.

It should be noted that the heat of wild animals is determined by two causes, the arrival of spring and the greater food supply which comes after a time of relative scarcity in most climates. Human forethought and ingenuity have practically annulled the influence of the seasons and have made the supply of food constant over the greater part of all the earth. But where degraded tribes exist in primitive conditions, virtually in a feral state, we find that women return to the animal type of menstruation. In the long, bright days of the Arctic summer, the Eskimo men and women pass into a state of ecstatic sexual excitement which is terminated only by satiety and exhaustion. It is at that season that the women become pregnant, for the most part. The comparatively refined women of Greenland often cease to menstruate during the long dark winters, and similar observations have been made in the high mountain regions of France and Switzerland. Barnes says flatly that some women menstruate only in warm weather. The immigrants who came to our shores forty years ago, after long voyages on short rations, came, as was often observed, in excellent health, but in a condition of amenorrhœa. In our north temperate zone, it can be shown that women of the robust type who nurse their children and do not limit their fecundity, have a tendency to bear children every second year in midwinter. So frequently does this occur that it leaves room to question whether there may not be still a breeding season for the human female, a faint fossil relic of primeval times.

In a comparative study, it must ever be remembered that perturbing influences tend to induce a more prolonged and uniform sexuality in

the human female. Her purely animal lust is complicated with spiritual affection for her mate, and this is in conformity to high poetic ideals; it is fused with æsthetic ideals, also; it finds its ethical restraints; and all of these human complications are only faintly prefigured in the psychology of the lower animals at the breeding age and the breeding season. With woman, primeval sexual instincts are continually cooled by prudence, modesty, conventional prudishness, and high intellectuality; it is inevitable that advancing refinement, and even increased comfort in life, should cause the phenomena of rutting to take on a less furious character and, as a corollary, a more uniform character through the year. And so the cycle of human rutting becomes much shortened.

It may well be that the function of menstruation will disappear in the course of ages, but in its last waning recurrences it will still be cyclical in its manifestations. It is a law of life and of all activity. The respiratory movements are rhythmic, and by a deeper breath at every seventh or eighth respiration we graft rhythm upon rhythm. There is a recurrence of hunger and of the propensity to sleep which is not in exact correspondence with the needs of the organism. In healthy persons of both sexes there is a diurnal tide in the pulse rate, the respiration, the arterial tension and the temperature. More than one competent observer has come close to a demonstration of that which is inherently probable—a tidal movement in the adult male of the human species during which all vital processes and the sexual appetite reach a climax and then decline to a minimum, so that the question has been seriously raised whether it is not true that men menstruate as well as women. And if we make the easy step from the physiological to the pathological, we find the same inexorable law of rhythm in the periodical recurrence of malarial paroxysms which the plasmodium has not fully explained, of epileptic seizures, of maniacal crises, and in the characteristic fever curve of the acute infectious diseases. Even in the highest intellectual activity we find the same law, for the creative power of genius has its ebb and flow.

The Time of Appearance.—That menstruation usually comes with puberty is a matter of common knowledge. In the United States that age may be put at fourteen years and six months, with wide individual variance from this average. Very frequently the function announces itself and is heard of no more for months; irregularity for the first year is too common to excite the alarm of most mothers.

Precocious menstruation may appear even in infancy. Hungry for marvels, women will often bring the baby's first diaper with a red stain upon it, and this is presented for blood in the case of a boy, and for menstrual fluid in the case of a girl. In almost every case the red patch will be found to be gritty under the finger, and its free solubility in warm water will confirm the diagnosis of red urates. Sometimes, however, in the case of girls, a small amount of blood will be found to come from a vulvo-vaginitis, with or without gonococci. Even

more rarely, granulations exist about the urethral opening sufficiently large and weak to produce a stain of blood. Millikin recalls a very puzzling case of a little girl who did not cease to "menstruate" until after a course of antisyphilitic medicine. The mother's many abortions furnished the clew to a diagnosis, confirmed after years by the child's dentition and the development of periosteal nodes. But a menstrual flow from the uterus of a healthy child is not to be denied. It may appear under the stimulus of disease, as in a case reported by Gemmell (*British Medical Journal*, vol. i, 1892), where a healthy girl of nine years, not hemophilic, had a flow of blood, squamous epithelium, and *débris*, which continued five days following the height of the eruption of measles.

There are many cases reported showing the menstrual tendency so strong that no stimulus of acute disease is needed to bring on the flow precociously. Millikin knows a case of two girls in whom puberty came, by gradual and symmetrical development, at the ages of eight and eight and a half years, respectively. Here, menstruation was a mere incident to perfect womanhood, for, though these little women had not attained their full stature, they had acquired rich voices, they cared little for children of their own ages, one of them suddenly became very averse to school, and the other attended to household matters with womanly enthusiasm.

More extreme cases may be cited, but here we trench upon the monstrous or the pathologic. Plumb (*New York Medical Journal*, June 5, 1897) reports the case of a child that weighed 9 pounds at birth, had genitalia similar to those of a girl of seven years, had pubic hair, but none in the axilla, and had a clitoris an inch and a quarter in length and of a diameter of half an inch. The mammæ were an inch in thickness and an inch and a half in diameter. Bathing the breasts caused erection of the clitoris; contact of clothing with the clitoris caused a complete orgasm. Amputation of the clitoris relieved her of reflex nervous disturbance. At six weeks she began to menstruate, and so continued until the age of six months when the report was made.

Irion (*op. cit.*, August 15, 1896) gives account of a girl of 9 pounds' weight at birth, with breasts and mons veneris well developed. She menstruated at the age of seven days, the flow continuing four days. A month later there was no flow, but from that time until the child was ten months old she was reported "regular."

Wladimiroff (*Archiv für Kinderheilkunde*, 1897) reports the case of a rhachitic girl, six and a half years old, 4 feet high, weighing 50 pounds. Her breasts, pubic hair, voice and modesty, all proclaimed her a little woman. She had menstruated once.

Klein (*Deutsche medicinische Wochenschrift*, 1899, No. 3) gives an account of a girl of ten months who had been separated from her parents up to that age. She was then found to be menstruating. She menstruated regularly for nine months. Then she had amenorrhœa

for four months, and then menstruated for seven months. At that time she had an attack of measles and ceased to menstruate for many months up to the time of the report. She was a delicate child of good mental development. Her breasts were of womanly shape and her genitals were large, with pubic hair.

Howie (*Year Book*, Gould, 1898) reports the case of a girl who menstruated from the age of three years and fourteen days. At each period she was languid and suffered malaise. She had pubic hair and prominent breasts.

Morse (*op. cit.*) reports the case of a girl who began to menstruate at the age of nine months.

Price (*op. cit.*) gives a case in which the child menstruated from the age of four years. Pubic and axillary hair appeared at eighteen months. Her breasts and bodily contour were womanly.

Lopez (*Revista de la Sociedad Medica Argentina*) reports the case of a child of five years which menstruated from the age of eighteen months. Each flux was of from three to five days' duration. The external appearances were those of maturity. The little creature was cursed with ardent sexual passions.

Rein exhibited before the Kieff Obstetrical Society a girl of six years who had menstruated regularly for a year. The breasts and external genitalia were appropriate to a girl of thirteen or fourteen years. The abdomen was enlarged, and a fluctuating, thick-walled cyst was diagnosticated.

Sometimes the ripe femininity of these little creatures is attested by maternity. Thus, McLaury, of New York city (*American Journal of Obstetrics*, 1887), sent a girl of thirteen years to a lying-in hospital. From her earliest recollection she had cohabited with men and boys. It is an interesting fact that she was one of four children born to an unmarried woman.

In 1858 there was a young mother, not quite eleven years old, living at the public charge at Taunton, Mass.

Dr. Gleaves, of Virginia, has reported the case of a girl who at the age of ten years and two months was delivered of a child of five pounds. She had menstruated from the age of five years. She had no mammary development, and her baby, during its short life of one week, was suckled by its grandmother, who had a child of only a few months.

These last cases might hardly be called exceptional in warm countries where men and women are so soon ripe and so soon rotten. In Ceylon a youth attains his majority at sixteen years and one may find the girls mature at from eight to fourteen years. Even in Mexico it is not uncommon to meet with grandmothers who are but little beyond the age of twenty years, and some cases fall much within this limit. One author, representing no extreme views, has stated that the average age of first menstruation is twelve years at the tropics, and sixteen years at the coldest civilized regions.

The Menstrual Cycle.—The menstrual month is a myth which has no other basis than the obscure moon-worship, latent in our race. For each woman, a definite and precise cycle is usually established, early in her menstrual life, but that cycle is seldom measured by precisely twenty-eight days. Vast numbers of women menstruate scantily every two weeks and enjoy perfect health. Upon inquiry, it will be found that many women menstruate every three weeks. A very large number of women are delighted to know that they conform to the classic period of twenty-eight days, but make their reckoning from the end of one period to the beginning of the next, so that they really have a cycle of about thirty-three days. In the same group are those who complacently declare that they are regular as the clock because they menstruate always on the same day of the calendar month. Millikin knows a case of two sisters who were in excellent health, but much disturbed because of menstrual irregularity, and it took much patient investigation to determine the fact that they had periods of thirty-seven and forty-nine days, respectively.

There is, in truth, no normal period of menstruation except in the sense that there is an average period of about twenty-eight days, from which most women depart widely. Exact conformity to this period brings no added grace, health, or fecundity; and contrary to the common belief among women, departure from it brings no peril. As a general rule, women highly refined and of delicate tissues will menstruate more frequently, while coarser, more robust women will menstruate less frequently.

The Quantity of the Discharge.—At each menstrual period, the human female loses from 2 to 14 ounces of fluid. As the estimate must be made from the collection of a few hours, it is not surprising that the range of variation should be so great. Individual differences are known to be very great, for, while one healthy woman will have merely enough discharge to stain her clothing, another, equally healthy, with like fixity of habit, will soak her cloths for two or three days.

No other mammalian female loses so much blood as woman. This we explain, first, by the fact that the reproductive apparatus of the lower animals has no other purpose than reproduction, whereas, in the highest of mammals it ministers to complex loves and likings and lusts which are only incidentally or accidentally reproductive. If the stimulus brought to bear upon the genitalia of the human female were ten thousand times less than it is, it would still suffice for the perpetuation of the species. There is therefore an abnormally high functional activity of the human uterus and all that pertains to it, if we allow the lower animals to fix the norm, and with this goes abnormal congestion and a tendency to increased leakage.

In the second place, it may be observed that the erect posture of the human female distinctly invites a free supply of blood to the pelvic organs and hinders its return to the heart. Such indeed is the law of all parts of the body lower than the heart. Man, the monarch of all

living things, erects himself in appropriate attitude and pays the penalty of his arrogance by suffering from varices, hemorrhoids and precarious nutrition of his hinder legs: his poor mate, to these lesser plagues, adds her characteristically profuse menstrual flow. We may add, as a third consideration, that the delicate tissues of the highly civilized woman are poorly able to resist the influences which tend to leakage of blood at the menstrual time.

In temperate zones the average duration of menstruation is about four days and a half. In any locality may be found great numbers of women who habitually menstruate two days, and as many who menstruate seven days.

Character of the Discharge.—There are occasional cases which furnish what has been well called white menstruation. The subjects usually announce themselves as suffering from a leucorrhœa which is "very weakening." Investigation, after excluding gushes of fluid from diseased tubes, and after establishing the periodic character of the discharge, will properly refer it to an attempt at menstruation which goes no farther than engorgement and supersecretion of the uterine glands. White menstruation is not pathologic and certainly does not demand surgical treatment.

The ordinary menstrual fluid is composed of mucus which comes at first from the uterus alone; at a later stage, the vaginal glands are also active and pour out their share of mucus. At an early stage, blood is mixed with this mucus, and the fluid takes on the tint of venous blood, or, by rapid decomposition of corpuscles, it becomes brown or black. Ciliated epithelium from the uterus is abundant, and a small quantity of epithelium from the vagina is also present. Remains of the endometrium are to be found abundantly. Fatty acids are present to give to the fluid its characteristic odour, and to prevent the coagulation of the menstrual blood. When the blood is present in high proportion, possibly because of a low amount of mucus and acids, clots form, to the dismay of the subject. Of all the components of the menstrual fluid, the blood is probably the least important. The hemorrhage is merely an untoward accident occurring in the course of important significant changes within the uterus.

That menstruation is an excretory process during which "bad blood" and nameless poisons are excreted, is an error possessed of notable vitality, for it has lived long and it dies hard. No one has suggested a mode or an avenue of elimination for this poison in men, boys, old women, pregnant women, little girls or women in whom surgery has brought on an artificial menopause; no one has detected it in the discharges; no one has pointed out any essential difference between women who menstruate freely and those who menstruate scantily. Nevertheless the fancied peccant substances will remain in literature for another century.

Millikin knows of courtesans enjoying excellent health who, with more knowledge of their trade than of transcendental pathology, have

learned the trick of *suppressing the menses* at will by the use of tightly packed sponges. A. W. Parsons, of Northampton, Mass., has taught many patients to tampon the vagina, partly for the comfort and neatness secured, and partly to limit the amount of discharge as might be thought good. In 1888 Gehrung recommended (*American Journal of Obstetrics*) the use of an alum-soaked tampon to be retained for forty-eight hours unless there should be leaking through or around it. He uses this tampon boldly to abbreviate or lessen the flow at his pleasure or to hasten the menopause. It was his deliberate purpose to reduce the flow to a limit of from 2 to 4 ounces, and this was accomplished in his therapy without a hint of harm. Loewenthal, in June, 1888, advocated the restraint of menstruation by intrauterine injections of hot water, or, occasionally, of iced water. He had greatly benefited 18 cases of chlorosis by suppressing menstruation for from three to five months.

The Inducing Cause of Menstruation.—Then, throwing aside the notion that the menstrual fluid is cast out by an active effort of the system to rid itself of a poison or a group of poisons, we inquire further into the inducing causes. From the very beginnings of medical literature, there is a hint that the blood of the human female was rich enough to force an overflow every four weeks, this capacity for plethora being born and bred in her for the benefit of her possible offspring. Without a fact to support it, this teleologic theory was unchallenged until late in the present century. More recently a very popular theory was, that Nature prepared a decidua for the coming ovum and that, when impregnation failed, for any cause, she entered upon a house-cleaning process which involved the casting off of the decidua, and, as Christopher Martin said, poured out a flood of blood from the turgid capillaries to wash away the useless *débris*.

Of late, some have been strangely impressed with the fact that the uterus has a rich nervous supply, its sympathetic fibres re-enforced by spinal filaments given off from the abdominal splanchnics, which send filaments to the uterus by way of the hypogastric plexus, and re-enforced also by fibres from the pelvic splanchnics which also pass through the hypogastric plexus on their way to the generative organs, the bladder, and the rectum. It has caused admiration, also, that the uterus has its own ganglia, giving it independent movement, even when dissevered from the body, and it has been announced that the uterus has anabolic nerves to retard, and katabolic nerves to accelerate, its metabolism.

But in all this, the uterus is not singular; its nervous organization is in every way comparable to that of other important viscera, for we believe that they all have motor, sensory, vasomotor, and trophic nerves. That the function of menstruation involves nervous apparatus is true, by all analogies, but that it is in any special sense a nervous phenomenon, is not true.

Ott (*Wiener medizinische Presse; Archiv für Gynäkologie*) has shown, as have many other observers, that there are slight changes in temperature, pulse, blood pressure, and respiration through the menstrual cycle, and that, carefully followed, these indicate that vital activity is at a maximum just before, or during, menstruation. Gathering up the large array of facts that show these trivial changes in vital processes, and show, also, that the daily excretion of urea and of carbonic acid is subject to slight variations through the menstrual cycle, Stephenson has held that the wave of rising vitality is influenced by a menstrual centre, wholly hypothetical as yet, which is, or ought to be, situated somewhere in the lumbar portion of the spinal cord, and which acts rhythmically to bring on *Stephenson's wave* and the accompanying menstrual flow. No explanation has yet been offered for the rhythmic action of the supposed centre. The advocates of this theory of menstruation are troubled little by the fact that similar waves are to be detected in the lower animals and in the males of our own species, and the doctrine may well be dismissed in the words of Stephenson, himself, who reduces the whole theory *ad absurdum* by his comment on the varying intensity of vital phenomena in the male: "it is therefore evident that the phenomena belong, not to the function of menstruation, but to a general law of vital energy."

A case of Rushton Parker's may here be quoted with profit. He was consulted by a couple who had been married eight months and had never accomplished coitus. The husband was twenty-four years old, and nothing could be seen amiss with him save that he had "a cowed look." He denied any practice of masturbation and also denied any sexual feeling. All organs were normal, save that the testes were small and soft. His wife had observed that he had a sanguineous discharge for three days out of every month. He readily agreed to a separation and a division of income. (*British Medical Journal*, March, 1899.)

Napier has suggested that the pressure of the enlarged utricular glands of the endometrial mucous membrane may be the stimulus, acting upon the terminal nerve filaments, to induce menstruation, and he has pointed out the fact that the time required for such growth in the constantly renewed mucous membrane, would correspond rudely with the intermenstrual period.

But we need not look for any accurate, mechanical explanation of this function. We can do no better in the present state of our knowledge than accept menstruation as a habit which has been nailed upon our race by heredity, and which is for us an ultimate biologic fact. This hypothesis meets all cases of menstruation without ovulation, all cases of menstruation after the removal of the pelvic genitalia and the destruction of their nervous apparatus, all cases of menstruation in infants and in withered old women, all cases of menstruation in men, and all cases of vicarious menstruation.

The Rôle of the Uterus.—It is often said, with essential truth, that "menstruation marks the destruction of the endometrial mucous membrane." If it does not do all this, it certainly marks the destruction of its highly organized, thickened superficial part, the decidua menstrualis. The endometrium is a mucous membrane highly specialized, to be sure, but not more so than the mucous membranes of the intestines and the stomach, and it certainly does not depart from the type so far as does the conjunctiva. It is distinguished anatomically by its delicate stroma and by its abundant glandular elements; it is distinguished physiologically by its power of self-renewal which recalls continually the fœtal tissues, the cells of malignant growths, and the tissues of the crustacea and lowlier forms of animal life. Delicate as it is, it is not thinner, but thicker, than most mucous membranes during the greater part of the menstrual month. It is essentially a uterine lining, for it does not extend downward into the cervix, or into the Fallopian tubes. At, or before, the menstrual time, it undergoes fatty and granular degeneration and is cast off in great part, and when discarded, it leaves the blood vessels in its basal substance unsupported. That the whole mucous membrane is discarded, is not believed; regeneration is accomplished by the remaining glands in the deeper layers, and is complete in about ten days after the general wreck has been effected.

These facts have been derived from the studies of many observers, but unfortunately they have been somewhat vitiated by the post-mortem delay in preparation of specimens, or by the impress of lethal accident or disease. For this reason we turn to our quadrumanous sisters and follow the admirable epitome of Walter Heape's labours, prepared by Lawrence for the Ohio State Medical Society in 1897. It will be understood that the researches cover studies made upon the lowly *Cynomorpha*, but mostly upon the higher group of *Anthropomorpha* which includes the lemurs, chimpanzees, orangs, and the gorilla.

Heape divides the menstrual cycle into four stages: 1. Rest; 2. Growth; 3. Degeneration; 4. Recuperation.

During rest there is only one layer of cubical columnar cells, with round nuclei. The protoplasm of cells is continuous with the protoplasm of the stroma network beneath. This epithelium is continuous with that of the glands beneath. The stroma has round nuclei embedded in a continuous network of protoplasm.

During growth the stroma nuclei are much increased by amitotic division and by fragmentation; this causes swelling of the superficial portion of the mucosa. Nuclei now become fusiform. Deep portions of stroma are not changed. Interglandular tissue swells, but the glands are not much altered. The epithelium, lifted by the dense layer of nuclei, becomes less dense. The blood vessels below the epithelium undergo hyperplasia. The more superficial layers of the stroma swell. Glands are widened. Many stroma nuclei are reduced in size, but the mucosa as a whole is increased in thickness.

During degeneration there appears hypertrophy of the epithelium, the stroma, and the walls of the blood vessels. Afterward, there is amyloid degeneration of the superficial layers of the mucosa. In this layer, congested capillaries break down with extravasation. At each point of rupture, red and white cells are swept into the stroma. The extravasated blood collects in lacunæ in the stroma, and these lacunæ, extending and dissecting, lift the epithelium. At this time, the deep portions of the mucosa are not infiltrated, and neither red nor white cells are found free. Leucocytes and stroma cells degenerate; the epithelium shrivels; lacunæ grow larger; degenerated epithelium is ruptured; blood is free in the uterine cavity. If, in any case, the lacunæ surround a gland, the gland is washed away. In this later stage of degeneration, leucocytes increase the number of their nuclei but are not seen to divide. Denudation is now complete; all the epithelium, portions of glands and sometimes whole glands, and even small portions of the stroma, are lost in the flood. The inner surface of the uterus appears ragged, with layers of masses of blood here and there. The deep layers of the stroma are wholly intact.

In regeneration, the epithelium is formed anew by extension from the torn edges or by the transformation of the stroma cells. New capillaries are formed and new blood vessels. New glands are formed by the infolding of epithelium. Extravasated blood is absorbed. Repair is complete; rest is at hand.

The Rôle of the Fallopian Tubes.—It is positively known by the dissection of women who have died by violence at different stages of menstruation, that the Fallopian tubes are much congested during menstruation and that, in most cases, at least, they are filled with fluid that contains blood corpuscles and epithelial cells. Robinson, of Chicago, after a study of 800 tubes from operative and post-mortem cases (*American Journal of Obstetrics*, September, 1891), confirms this, and expresses his belief that the ovum is more easily preserved and wafted through the tube while thus filled with fluid.

Besides what is known, it is certainly very probable that the congestion and contraction of the tube leads to its erection, and that, during some part of menstruation, it has a gross movement of peristalsis, while the cilia of its epithelium become active. That the tubes have much to do with the excitation which precipitates menstruation, might well be supposed from the fact that they are continuous with the uterus, and the additional fact that they have a nerve supply identical with that of the fundus. Tait says that 90 per cent of cases will not even menstruate once, after the removal of the tubes.

The Rôle of the Ovaries.—Some have admitted the theory, wholly fanciful in the present state of our knowledge, that the ovary is, in part, a ductless gland and that its secretion, having accumulated in the tissues of the body to a certain saturation becomes the proper stimulus for menstruation.

Waiving this doctrine, which is capable neither of proof nor disproof, we may say that the ovary has but one function, viz., ovulation, the production of ovules whose highest destiny is to be fructified in the Fallopian tube and developed in the uterus.

It is a matter of regret that the term ovulation is a vague one. It is used, commonly, to comprise processes which cover much time, possibly months. We have reason to believe that it takes long for the young Graafian follicle to assert itself, deep in the stroma of the ovary, and still more time before it appears on the surface of the ovary as a mass of vascular loops, and yet more time before the wall becomes nonvascular, fatty and friable, for the escape of the ovule. And even then, according to the notions of some, ovulation is not accomplished until the Fallopian tube receives the ovule and sends it to the uterus.

Making the term cover only the latter part of this long process, however, we put upon it a time limit of days rather than weeks, and come upon a wilderness of doctrines as to the relation of ovulation and menstruation.

It is held by Pflüger and his followers that menstruation is a result of a nervous discharge caused by the bursting of a Graafian follicle and the liberation of an ovule. Raciborsky found ripe or ruptured follicles in healthy and menstruating women who had met with sudden death, as did Leopold, also, and their opportunities for investigation were ample. Unfortunately for the theory, they also found many ripe follicles unruptured. Walter Heape puzzles us by a statement that in *Macacus rhesus* the breeding season is strictly limited, but that menstruation continues regularly all the year round. Out of 16 cases he has found a recently discharged follicle in only 1 case. He has not seen a clot in a follicle in any case. His researches on *Semnopithecus* agree with these observations, and lead to a conclusion that ovulation and menstruation have no relation in these species. Leopold's studies were made upon twenty pairs of ovaries of women whose menstruation was recorded, and he could only say that rupture took place most frequently at menstrual periods, but might occur at any time.

It is held also, by some, that the passage of the ovule through the Fallopian tube is the immediate stimulus for menstruation. This is not inherently impossible, for, as we have remarked, the nervous and muscular anatomy of the tubes makes them almost one with the menstruating organ, the uterus. But we are barred from dogmatism here by our ignorance of the duration of the transit of the ovule through the tube, for the authorities vary in their estimate from one day to eight days.

We do not even know whether the escape of an ovule from the ovary and its journey to the uterus precede or follow menstruation. Naegele taught that the ovum could live in the newly prepared uterus for some time after menstruation was completed, and that, failing to

be fertilized, it was cast off with the decidua at the next menstruation. Loewenthal's doctrine is not far from this, for he teaches that the ovule always embeds itself in the endometrium and stimulates the formation of the decidua menstrualis; at a later date, if still unfertilized, its death brings about that congestion which ends in menstruation, though he holds all hemorrhage to be accidental and pathologic. (*Archiv für Gynäkologie,* Bd. xxiv, p. 2.) Barnes also taught that the unfertilized ovum, of some considerable age, is cast off with the decidua menstrualis, but he conceived the plausible idea that there was habitually another ovule on the road to the uterus at the time of menstruation.

This jungle of theories will not be cleared until we master fundamental facts which at present are beyond us. We need, first, to collect all the ovules which pass from a woman, but their fragility and their microscopical dimensions will forever forbid such investigation. We need, secondly, to be able to read the record of ovulation which is left in the corpus luteum; but Cohnstein is not alone when he declares that we have no means of estimating definitely the age of one of these bodies.

We are therefore obliged to return to the principle enunciated in a former section, and to say that menstruation is a habit of the female organism, inherited and fixed beyond her present needs, and to that we add that ovulation may occur at any part of the menstrual period cycle. Avoiding any more definite creed, we are not dismayed by the following anomalous cases which are entirely inexplicable on other theories of menstruation and ovulation.

In girlhood, and even in childhood, ovulation is active without menstruation, and is sometimes attested by pregnancy before the menses have appeared. Robinson, of Chicago (*American Journal of Obstetrics,* September, 1891), says that an examination of 800 ovaries convinces him that ovulation begins before birth and continues into old age.

Conception, implying ovulation, occurs in many nursing women who do not menstruate.

Menstruation occurs in some exceptional women only during pregnancy.

Menstruation occurs exceptionally after the removal of the ovaries.

Girls and other young mammals have ovules even at birth, long before the period of menstruation.

De Sinety found a fresh corpus luteum in a young woman who had died of phthisis, though she had not menstruated for many months. Vermeil and others have reported similar cases.

It is known that some women who have long passed the menopause, ovulate.

In rare cases women who have ceased to menstruate become pregnant.

The Hygiene of Menstruation.—The primitive man looked upon his genitalia and those of his mate with worshipful regard, first, as a fetish, and later, as an incarnation of the creative principle in Nature. Most women, and even some men with microscopes, have failed to outgrow this savage theology, and upon small knowledge of the genitalia have grafted an incredible mass of barbaric superstition and crude folklore. More or less vaguely, women hold to the belief that menstruation is a season of peril, and the general drift of the best teaching is to the erroneous opinion that menstruation is a pathologic process which must be skilfully guided to an end by the craft of the physician. It would be well if this had definite form, for then it would become vulnerable and absurd; as a matter of fact it survives in misty form in the subliminal consciousness of the race, beyond the reach of logic or persuasion.

Menstruation being a perfectly innocuous, physiologic process, it may be said that the hygiene of menstruation is the hygiene of all the year round. The woman who conserves her general health and maintains herself in the highest possible vigour has done all that can be done to make menstruation safe and easy.

In negation, we will say that there is no need for putting the young girl to bed during her first few periods, and still less excuse for putting a poultice on her, as a distinguished author has recommended. Clothing should be changed at need, in spite of the protests of old women; and there is never so much need of a daily sponge bath as during the menstrual time. The salutary truth, that filth and health do not agree, should be pressed upon the young girl and upon the older woman who complains of an ill-smelling menstrual discharge when, in fact, she is offensive from the rancidity and putrescence of axillary secretions. The fishermen's wives in Europe, the bathing attendants at the seashore, and the patients at water-cure establishments are not, in general, permitted to abstain from contact with water at the menstrual time, and they are not aware of any great harm resulting from the exposure.

In the early stages of Raynaud's disease, Basedow's disease, phthisis, chlorosis, and a number of forms of anæmia, amenorrhœa is an early symptom. In the late stages of disease, the wretched female patient often looks back over her career and recalls to memory some one of the traditional causes of suppression—a bath, a drenching, or what not—and with poor logic she connects the exposure, the suppression and her ruined health in a causal chain. Experience, the fruitful mother of all error, has its preconceived theory; it marks the hits; it forgets the misses; it perpetually confirms the error with which it began. And so it happens that the greater number of women are, at the menstrual time, fearful of harm when they make a toilet for the skin, or put the hands in cold water, or walk, or ride, or dance, or do a thousand things which are considered proper and safe during the intermenstrual period.

The list of complications which are said to go with menstruation is one which might be safely attributed to a group of men. It includes constipation or diarrhœa, subjective sensations of heat or cold, increase or diminution of urine, anorexia or craving appetite, increased activity of the sudoriparous glands, pigmentation of the skin, yawning, cramping, hiccough, meteorism, palpitation, and irritable temper!

For a short period at the very height of menstruation, the bodily temperature is elevated about half a degree. In very impressionable persons, this causes a slight feeling of lassitude. A certain slight dragging sensation, a feeling of weight in the legs, and a definite though slight pain in the sacrum, groins, and thighs, often cause menstruating women to take more than their usual repose. It would not be wise to induce such women to exercise violently; neither, on the other hand, is it wise to coddle them and cultivate valetudinarianism.

CHAPTER XLVI

THE DISORDERS OF MENSTRUATION

Menorrhagia, general systemic causes, local causative diseases above the pelvis, pelvic causes; treatment—Metrorrhagia—Amenorrhœa; treatment—Retention of menses, symptoms and diagnosis; treatment—Dysmenorrhœa; treatment—Membranous dysmenorrhœa—Intermenstrual pain—Vicarious menstruation—The menopause.

Menorrhagia.—Menorrhagia is an excessive flow from the uterus at the menstrual time. Only its periodicity distinguishes it from metrorrhagia.

We can hardly conceive of hemophilia as a cause of menorrhagia. Women transmit this defect of constitution, but the disease is so manifestly incompatible with menstruation that Nature has long since stamped out the tendency to hemophilia in the female.

General Systemic Causes.—(*a*) In *purpuric conditions* we have a strong tendency toward menorrhagia, for in this disease the blood is altered in such wise that it has a manifest tendency to transudation, and a loss of its normal coagulability. Menstruation opens the door and the flow is excessive. (*b*) In all forms of *anæmia* we have a relatively great amount of water in the blood, a relatively diminished amount of albuminoid substances, and diminished coagulability. Chlorosis, in this regard as in many others, stands apart from the anæmias, for it tends to scanty flow, if any. (*c*) In *plethora* the increased flow is due to high arterial tension rather than to a morbid condition of the blood. (*d*) In the different *chronic forms of nephritis* we have an altered condition first, of the blood, and, later, of the blood vessels, both disposing to hemorrhage. (*e*) In *malarial poisoning* we have the bleeding tendency well marked, not alone in the uterus, but also in the rectum, bladder, and nose. (*f*) In any form of *debility*, menstruation is apt to run into excessive hemorrhage from inability to promptly repair the endometrium. (*g*) In the *specific infectious diseases* we have reason to believe that hemorrhage is often excessive by a combination of depraved blood, altered blood vessels, and the debility of an organism that is too busy with the disease to make repairs in the uterus.

Local Diseases above the Pelvis, causing Menorrhagia.—(*a*) *Violent emotion* has often been known to increase the menstrual flow, even to the danger point. We are obliged to assume that it causes vasomotor

paralysis. (*b*) In *cardiac disease* with venous stasis, extravasation is invited. Stagnant blood, dammed back in the veins by an inefficient heart, seeks a place of least resistance even in the male patient. In the female the place is indicated plainly, once a month. (*c*) *Pulmonary disease* may run such a course as to obstruct the pulmonary circulation early, thus wearing out the right heart and leading to venous stasis. Ordinarily, the early course of the disease is toward amenorrhœa, or scanty menstruation, and the blood is rich in the coagulating principle. (*d*) In *hepatic disease*, the return of blood from the uterus is impeded, and there exists in jaundice the hemorrhagic tendency which is the plague of the surgeons. (*e*) In *splenic disease*, also, there is some obscure alteration of blood or of blood vessels disposing to hemorrhage as in uræmia. All these causes of menorrhagia are rare, however. (*f*) In a given number of cases of *abdominal tumour* we shall find a great number of cases of menorrhagia due to pressure of the great venous avenues of return of blood and to the perturbing influence of pressure on the uterus. (*g*) Yet, the commonest cause of menorrhagia, after all, is the *fæcal tumour* so often present in the female patient. It, like any other abdominal tumour of its size, operates viciously by compressing venous trunks; it presses upon the uterus and directly irritates the organ; it is liable, through the sympathetic system, to irritate the nervous apparatus of the uterus and increase its arterial supply; by its downward pressure it aggravates every flexion and version; it slowly establishes a condition of stercoræmia and hydræmia; it breeds a tympanitic tumour in addition to the solid fæcal mass, and thus still more increases pressure.

Pelvic Causes of Menorrhagia.—But for the etiology of menorrhagia, we look most to the bleeding organ itself and to its neighbours in the pelvis. The uterus and tubes are anatomically continuous and virtually inseparable by dissection. These organs and the ovaries have a common nervous supply. The whole trio is fed by only two pairs of arteries, and their veins are few and simple. It is, therefore, inherently probable, and it is clinically proved, that irritation or inflammation of one of these organs must lead to exalted function of the other two.

Passing to the uterus itself, we note that one of the most common causes of menorrhagia may be found in the *subinvolution of the uterus* after abortion. Subinvolution may also occur after delivery at full term, especially if it is not followed by lactation.

In the condition known as areolar hyperplasia, sometimes reckoned a true *chronic corporeal metritis*, we have a flabby, atonic state of the uterus with enough inflammation to determine much blood to the uterus and to limit its power of repair after the menstrual wreck.

Inflammation involving the endometrium tends to produce menorrhagia, and this tendency is especially well marked in the cases where large granulations are produced on the interior surface.

Healed *lacerations* of the cervix and deep *ulcerations* at the same site sometimes seem to be starting-points for an irritation that disposes to an increase of menstrual blood.

In malpositions of the uterus we have often the greatest irritation leading to increased blood supply. In some of the malpositions, the veins of the broad ligament become varicose from distortion and long-continued pressure. The blood returning from the small vessels of the endometrium passes into the uterine sinuses and thence toward the heart by way of the veins in the pampiniform plexus, and it is evident that any limitation of the carrying power of the veins of this plexus will produce some degree of stasis in the uterus.

Uterine tumours also act in this double manner to cause menorrhagia; they vastly increase the normal irritation of the uterus, and they act in a mechanical manner, by pressure or by dragging, to block the veins of the broad ligament. Subperitoneal tumours do less harm than those which lie in the wall of, or under, the endometrium. After *incomplete abortion*, when some portion of placental tissue remains rooted in the endometrium, the menstrual flow is sometimes enormous. The irritation is out of all proportion to the size of the offending body. Malignant disease of the uterus often leads to menorrhagia at an early stage. Sometimes the menorrhagia has no provoking cause that can be detected. The theory of congestion is then invoked to cover our ignorance. Reinecke and others have, of late years, developed the fact that in some cases of menorrhagia the uterine arteries are sclerosed, prematurely old, prominent, and incapable of contraction. They carry a maximum of blood and necessarily tend to menorrhagia.

Treatment of Menorrhagia.—When menorrhagia is due to plethora, the tendency is toward automatic palliation. Later, the volume of the blood may be diminished by purgatives, exercise, and restricted diet.

In all forms of hydræmia, the treatment must look to restoring to the blood its nutrient principles and especially its saving power of coagulation. In the very time of menstruation, every means of limiting the discharge should be used; for each hemorrhage, by impoverishing the blood, invites a more profuse and prolonged hemorrhage. The bowels should be kept open without violent purgation. The subject should lie rather than sit. The feet should be warm, day and night. In urgent cases the tampon should be applied in such a manner as to correct any malposition of the uterus, and it should make firm pressure on the cervical tissues. Since it is not the object to coagulate the blood in the vagina, no styptic substance should be used. The tampon should rather be treated with some antiseptic substance like boric acid which is only slightly toxic, is inoffensive, and has a faint acid reaction, to avoid neutralizing the normal acids of the vagina. In extreme emergencies the uterus might well be flushed with hot water at 110° to 115° F., under asepsis and with free return of fluid secured. The emergency passed, the attempt should be made to improve general nutrition and to enrich the blood. The milder, scale preparations of

iron have great value for prolonged use. In the presence of a brisk hemorrhage, the tincture of the chloride of iron is of most value. The common impression that iron increases an existing hemorrhage has no basis in fact. Arsenic is of great value in anæmia, and may well be alternated with iron.

The debility which leads to menorrhagia is often based on some hemic defect. It will often demand a blood count and estimate of hemoglobin with a study of excreta for a comprehension of its causes.

Menorrhagia complicating the acute infectious diseases is seldom severe or long continued. In the exanthemata, it usually declines with the development of the cutaneous eruption. In scorbutus, treatment must be addressed chiefly to the underlying disease, and that treatment is dietetic. In menorrhagia resulting from nephritis, the treatment must reach the underlying disease, also. In malarial cases, treatment for the toxæmia will accomplish brilliant results even in an emergency. The chief danger in menorrhagia is that the physician will, with mind prepossessed, seek for a cause in the pelvic organs and overlook some profound disease or dyscrasia. Menorrhagia caused by great disturbance of the emotions should be treated by palliative measures at first. The menorrhagia, curiously enough, tends to repeat itself for a few months. When this affection is a result of cardiac or of pulmonary disease, it needs virtually no treatment save that which is directed to the relief of venous stasis. In pulmonary disease, the ultimate tendency to amenorrhœa will be an aid. When menorrhagia complicates hepatic, splenic, or renal disease, the treatment is mostly palliative, while the fight is made upon the causal disease. In advanced stages, when a cachexia has been established, menorrhagia is rarely a complication. The treatment of abdominal tumours is a matter of surgery, not to be considered in this chapter. The treatment of fæcal tumours is of the greatest importance and may be here discussed. They should be swept out by repeated doses of purgatives. In severe cases, it may be necessary to aid purgatives by enemata or by tunnelling through hard masses in the rectum. If it is known that there is no obstruction, calomel may be given in an efficient dose combined with podophyllin, or any of the more powerful vegetable purgatives. For initial purging, the salines may suffice. They have a special value in their power to cause a free osmosis into the intestinal tube, reducing incipient inflammation and putting an end to the absorption of poisons from the intestine into the blood. Repeated enemata, each measuring half a pint, of a saturated solution of magnesium sulphate, retained as long as possible, will often produce great results and save the patient the annoyance of large and repeated doses of medicine *per os*. When the bowel is well emptied, it is important to keep it empty to the physiological limit. Radical and abrupt changes in diet will have some effect, but very little, in the average woman of constipated habit. The laxative power of fruit is a fiction from Paradise. So long as it is a novelty, oatmeal is sometimes an efficient laxative, but the system is

soon habituated to it. Mustard seed or flaxseed, swallowed without mastication, is oftentimes very efficient. Senna, the basis of most of the secret purgative and laxative teas and syrups, is to be commended in small doses for a limited time. As an alternate medicine, cascara sagrada is most excellent. The intestines rarely become habituated to this medicine. Atropine and strychnine seem to have some effect in breaking up constipation.

It has long been taught that a sharp purgative, preferably a mercurial, given a short time before menstruation, has a distinctly curative effect in some cases. The treatment should be kept up for some months. It may be conceived that the benefit is accomplished by depleting pelvic viscera, diminishing a mild metritis, and exercising a tonic nervous action on the uterine blood vessels.

Supposing the bowels to be in good order, one may resort to ergot and its allies, ustilago and gossypium, with a hope of permanently contracting the fibres of the uterus and the muscular fibres of uterine and ovarian arteries. The liquid preparations of these drugs are so bulky and offensive that tablets of ergotin are to be preferred. The treatment is of no avail in emergencies, but under ordinary circumstances should be maintained for one or two months at least.

Excellent results will sometimes be attained by giving potassium iodide for ten or twelve days previous to the menstrual time. The dose should rise, as rapidly as tolerance will permit, from 10 to 40 grains per diem, and be there maintained until the second day of menstruation. Apart from any obscure "alterant" action, the drug produces its benefits through known channels. It has a power of dilating systemic arteries and lowering arterial tension; it improves the nutrition of the heart, in many cases, by its direct action on heart muscle and by its action on the coronary arteries; it cures bronchitis and bronchitic asthma and moderates the complications of emphysema, thereby lightening the labours of the right side of the heart and diminishing venous stasis; it palliates concealed syphilis. For prompt and evanescent action as artery dilators, alcohol and the nitrites may be used. Digitalis has no place in the routine treatment of menorrhagia. It is only indicated in cases where the hemorrhage is caused by some cardiac disease demanding the drug.

The use of styptic substances *per os* has no other justification than a credulous hope that the stomach may be induced to take up so much of the drug that the blood will be saturated to a degree sufficient to check undue hemorrhage at a distant point. Quinine, strychnine, and atropine, have no direct effect upon the hemorrhage, but have great value when it is desired to whip up circulatory or respiratory centres, or the lumbar centres which send fibres through the hypogastric plexus to the uterus and its appendages.

In rare cases, supposed to be caused by ovarian irritation, the bromides will diminish the menstrual flow. They certainly tend in the main to diminish the flow, and, as Ernst, of Vienna, has pointed out,

to increase the interval between menstrual periods. Whether, for the benefit reached, it is well to blanket the whole nervous system with a depressant drug, is a question.

Electricity has doubtless a place in the treatment of menorrhagia, though it will be the resource of the few. The positive pole in the uterus, carrying a galvanic current has an admitted hemostatic effect, the current being cautiously raised to from 30 to 50 milliampères. Later, in the absence of hemorrhage or inflammation, the current may be much increased. In any case, a cure can not be expected under a treatment extending over months. In emergencies, the current used in the interior for hemostasis may be raised to 150 milliampères, and it must be understood that it is then positively cauterant. Strict antiseptic technique must accompany this treatment. (Goelet, *New York Medical Record*, March 28, 1891.)

Desperate cases of menorrhagia may require the induction of the artificial menopause by the aid of the surgeon.

Metrorrhagia.—Metrorrhagia is a hemorrhage from the uterus in the intermenstrual period. Time was when menorrhagia and metrorrhagia were a long way apart, but it is now perceived that all red fluxes from the uterus are essentially hemorrhages, and all akin. When we meet with a metrorrhagia which begins in an intermenstrual period, continues with increased volume through a menstrual period, and so runs on for weeks, we perceive small difference between the two affections; or, if we encounter a case of sharp menorrhagia which each month lingers longer through the intermenstrual period to become at last an unbroken flow, we must admit that our classification is artificial and a matter of mere words. The reader is, therefore, referred to the preceding section for the causes of metrorrhagia in general, since these uterine hemorrhages are not sharply distinguished in their etiology.

Metrorrhagia in early life almost always points to anæmia, and particularly that anæmia which is very properly referred to stercoræmia.

In young married women, metrorrhagia should excite suspicion of incomplete abortion. In such cases curettage should be done after the technique laid down in another part of this work. The mechanical removal of the wreckage of an incomplete abortion has the added advantage that it gives opportunity to remove the dilated follicles that maintain uterine hemorrhage in low grades of endometritis, whether the endometritis is a result of abortion, or not. The operation also clears the diagnosis by giving information of intrauterine tumours.

In mature life, metrorrhagia, much more than menorrhagia, should excite suspicion of uterine cancer. Such subjects, approaching the menopause, look complacently upon an intercurrent flow as a sign of vigour or of plethora. They know that pain and fœtor belong to cancer, and, having no knowledge beyond this, they pass, still in good general health, beyond all possibility of surgical aid. In the present state

of our knowledge, it would be well if every case of metrorrhagia in women past thirty-five years were held to be a case of cancer until the contrary was proved. In the absence of a visible and tangible mass of malignant growth, the physician should still hold doubts as to small adenomata of mucous glands of the endometrium. In 2,200 cases of metrorrhagia, Baer found 41 who had malignant disease of the uterus. Only 3 of these were younger than thirty-five years; only 5 were older than fifty-five years; 26 of them fell in a group in the years between forty and fifty-five years of age.

Metrorrhagia is sometimes maintained by a sclerosis of arteries, as in the case of menorrhagia. Leopold, in 1896, made 4 extirpations of the uterus in women who had borne from 4 to 12 children, and found the uterine arteries large, tortuous, thick, and gaping. The vessels projected above a cut section. The thickening was of the median layers, the intima not being affected. The extirpations were made for suspected malignant neoplasm. Curetting had been of no avail and ergot had appeared to increase the hemorrhage.

When the floor of the pelvis has been broken down, with great damage to the levatores ani and to the recto-vesical fascia, metrorrhagia is likely to follow in the course of years, and to be so intractable that surgical treatment only will avail.

The *general principles of treatment* laid down for menorrhagia apply here. In metrorrhagia, intrauterine applications will work a cure in a larger proportion of cases than in menorrhagia. The cervix being sufficiently dilated, iodine in solution; phenol, pure, diluted, or combined with iodine; creosote in solution; or tannic acid, may be carried up to treat the entire endometrium with the hope of diminishing succulence or atony, or of reducing inflammation. The solution of these and other styptic and cauterant substances is often made in glycerine, and that solvent, by virtue of its great avidity for water, is able to deplete the endometrial tissues and new growths.

Amenorrhœa.—Amenorrhœa is not a definite disease or even, in all cases, a symptom of disease. By the term is indicated merely an absence of menstruation. Amenorrhœa may be physiologic, as in nursing women and in pregnant women, or it may be symptomatic of some wasting disease.

An interesting group of women appear to be perfect in their development and yet never menstruate. Not all such women are sterile, though conception is excessively rare among them. Millikin has knowledge of one such case, a woman who has been happily married for twenty years. Hubbard Winslow Mitchell (*New York Medical Record*, March, 1892) reports an Irish immigrant, well developed as to genitalia and breasts, who had never menstruated. Withrow, of Cincinnati, has reported the cases of two sisters, and the daughter of another sister, who had never menstruated. All three of them had enjoyed the sexual relation and all were sterile. Two of them had profuse periodical epistaxis.

It would appear that this condition of amenorrhœa may be acquired, as in the notable case reported by Petit (*Annales de gynécologie*, 1883), in which the woman of twenty-one years was found with a child between her thighs, an inverted uterus and an adherent placenta. Reduction was accomplished, and, after a tedious convalescence, she was restored to health in the course of eighteen months. Although she bore a child after two years and a half, another in sixteen months, and her fourth child after six years, she never menstruated and never had leucorrhœa.

In most cases of lifelong amenorrhœa something teratological appears. Thus, Walter B. Chase (*American Journal of Obstetrics*, No. 4, 1898) records the case of a woman of good physical development who had the menstrual molimina every twenty-eight days from the age of eighteen; she married at twenty-two years and came under his notice at twenty-four years of age. She had been sterile through two years of married life. Her periodical pain was unbearable, and insanity was feared. Her abdomen was very fat but tumour was diagnosticated. Operation revealed a thin-walled sac subdivided into cavities of which some were, and some were not, infected, and a teratoma containing sebaceous matter in emulsion, hair plates, and bone. No Fallopian tubes were found. A small amount of ovarian tissue was flattened on the wall of the multilocular cyst, with an imperfect corpus luteum. Manton reports (*American Gynecological Journal*, March, 1891) a woman of twenty-two, married three years, who had never menstruated, but for four or five years had suffered, periodically, with abdominal cramps, severe headache, and, occasionally, tender and swollen breasts. She had no vagina, but the husband's perseverance had made, at the fossa navicularis, a pouch 3½ inches deep, leading nowhere. Rectal examination with a sound in the bladder showed the ovaries in proper position, but no uterus could be found. Manton has seen a girl in a similar condition. She seemed to enjoy such "intercourse" as was possible to one who, in lieu of a vagina, had a cul-de-sac of a depth of only 2 inches. Herbert C. Jones, of Decatur, Ill., gives an account of a woman of size and stature above the average, who consulted him as to a vaginal discharge. She had never menstruated. He found that she had a capacious vagina, a large, hooded clitoris, a uterus three quarters of an inch in depth, and no ovaries to be distinctly palpated. She had no mammæ, and her nipples were rudimentary. Her statement that sexual intercourse gave great pleasure was confirmed in a day or two when it was determined that her discharge was from gonorrhœa contracted the second year after marriage through illicit intercourse.

In young girls, there is often a period of amenorrhœa following hard upon the first one, two, or three, menstrual periods. In most cases this failure is due to anæmia.

Treatment of Amenorrhœa.—Since amenorrhœa is only a symptom, it can not in strictness be said to require any treatment. The treatment should be addressed to the diseases or dyscrasiæ of which it is sympto-

matic. The amenorrhœa which comes to many young girls soon after menstruation announces itself, should not be meddled with. It is a confession that Nature's first attempts were premature. The amenorrhœa of some young girls is, however, a danger signal hung out to give warning of the earliest stage of phthisis. The treatment of the symptom is wholly included in the appropriate treatment of the disease.

Anæmia should also be suspected in well-grown girls who have passed the usual age of menstruation. Most cases will be found to have dyspepsia as the underlying condition, and the dyspepsia will generally depend upon physical inaction, incessant nibbling without real meals, addiction to sugar, which, valuable as it is, will destroy the appetite and lead to fermentative dyspepsia as girls use it and abuse it. Coffee toping is a common cause of dyspepsia at this age. Whimsical appetites for ice, uncooked rice, laundry starch, uncooked prunes, and miscellaneous rubbish may often be detected by adroit questioning, and it will be found that these substances in many cases, not only displace the regular meals, but lead to a positive gastritis, the pains whereof are interpreted as an all-day hunger to be satisfied only by the trash that bred it. The subjects of these whims are often fine, strong girls, who will do well if they can be brought to take no food save at regular meals with limitations as to coffee, sweets, and raw fruits. An astonishing number of girls are ignorant of the fact that the human stomach needs long periods of profound rest; the truth once presented to them by authority, they will often take the reform in their own hands with honesty and enthusiasm.

Constipation, or coprostasis, which in the older woman is sometimes the source of uterine hemorrhage, in the young girl very frequently produces such a degree of anæmia as to suppress the menses. Many young girls are so loaded with fæcal products that the breath has the odour of a night-cart. Here again, ignorance combines with laziness or modesty to aggravate the condition. It is very easy to convince the average girl that it is a filthy and degrading deed to go about loaded with some pounds of excrement, and when that is done the case is half cured. Purgatives are not indicated in these cases. The formation of the syringe habit and the absolute annihilation of the rectal conscience is most deplorable. A course of laxatives, of which cascara is usually the best, combined with deep massage, rational physical exercise, and an immediate response to the rectal call, will not only get the bowel empty, but will go far to establish the habit of a daily evacuation of the bowels. Until the stercoræmia has been corrected, one need not attempt to correct other causes of anæmia; when the bowels have been unloaded, and when the digestion has been amended, one should settle the question of the existence of albuminuria, malaria, syphilis, saturnism, splenic disease, or whatever dyscrasia may produce anæmia in young subjects. When all cases have been sifted, there will remain a residue of girls, and boys are not exempt, who, without apparent cause, develop the "anæmia of adolescence."

For the medical treatment of this anæmia, the whole range of hematinic drugs may be invoked. Iron and arsenic are the chief of them. Manganese has acquired a reputation probably far beyond its deserts.

Apiol, an amber fluid obtained from parsley seeds, has been highly extolled by the French as being able to produce the menstrual flow. It is given in doses of from half a gramme to a gramme and is said to be wholly innocuous. The use of oxalic acid in half-grain doses, given every four hours to three doses, is said to be very efficient as an emmenagogue, but it is admitted that toxic effects have followed such treatment. All emmenagogues are open to an objection that they merely solicit a flow which ought not to be directly solicited, and which is sure to appear when the physiologic conditions of menstruation are present. This objection applies to the old and popular terebinthinate emmenagogues, and to those composed chiefly of essential oils.

It should, indeed, be a general principle of treatment that it is not worth while to bring on the menses, but rather to annul, if possible, the morbid conditions under which they disappeared. We have already noted the fact that there is a tendency toward amenorrhœa in the presence of any notable hardship, and we shall be consulted, perhaps, when that hardship has passed away. Even a mere change that does not involve hardship, will sometimes produce amenorrhœa, as when a girl leaves the country and enters a factory, or *vice versa*. Curious cases are sometimes observed in which amenorrhœa develops after marriage and persists for some months without pregnancy; and precisely reverse cases are observed in which amenorrhœa comes with widowhood. These cases are inexplicable in the present state of our knowledge, and should not be rashly meddled with.

The same principle applies to amenorrhœa developing in the course of exophthalmic goître, Raynaud's disease, myxœdema, and in connection with the sudden and grave development of fat. If we can amend the disease, we are likely to cure the amenorrhœa; if not, the amenorrhœa can do no harm.

Retention of Menses.—In amenorrhœa no menstrual fluid is produced. In retention, the fluid is formed but does not manifest itself externally.

For this seclusion there can be but one cause, viz., occlusion of the genital canal at some point. (See Malformation of the External Genital Organs.) The occlusion may be at the os internum, or at the hymen, or at any intermediate point, or at all points at once.

When the stenosis or occlusion is congenital it may be charged to an arrest of development.

Acquired stenosis of the vagina may be produced by severe inflammation after parturition, as in Battey's famous case in which the entire utero-vaginal canal was obliterated. It has also been produced by severe croupous or diphtheritic inflammation with destruction of epi-

thelium, and by Nature's blundering repair after burns or destruction of tissue by escharotics.

Clumsy surgery has produced stenosis by amputation of the cervix, especially when the amputation has been done by cautery. The operation of trachelorrhaphy has been so done as to cause stenosis of the cervical canal.

One third of all cases are due to an imperforate hymen, and, as a rule, the obstruction is external and vaginal rather than cervical or uterine.

Symptoms and Diagnosis.—Apparent amenorrhœa, with the menstrual molimen recurring regularly, should excite suspicion of retention. The ordinary pains of menstruation may be much exaggerated by the retention, so that the pelvic dragging, aching thighs, legs, and sacrum, the flushed face, headache, nausea and malaise, will become almost unendurable.

The general symptoms of sepsis must be added after a time.

Peritonitis may arise, either as a part of the septic process or as a result of expression of fluid from the Fallopian tubes. Rupture of the tube has occurred in rare cases.

Bulging of the hymen will lead to a diagnosis if the obstruction is due to an imperforate condition of that structure.

From the first, the confined fluid forms a tumour which, growing monthly, sooner or later attains palpable dimensions. If the fluid is confined to the uterus, the mass will be round; if a tube is involved, the mass will be asymmetrical.

Pregnancy is not absolutely excluded when the hymen seems imperforate or when the vagina is closed. But in retention, by using the bimanual method, the uterus may be found central, mobile, and too small for a pregnancy which has lasted as long as the amenorrhœa; this, of course, tends to exclude pregnancy.

When the vagina is not available, a finger should be introduced into the rectum and a sound into the bladder, and in difficult cases of diagnosis a finger has been introduced into the bladder also, through a dilated urethra.

Solid and cystic tumours arising from the genitalia are diagnosticated by the passage of the uterine sound and by the history of the case.

Hematocele is diagnosticated by a history of rapid development, often with pain and shock, and the diagnosis is confirmed by the passage of a sound.

Abdominal tumours must be considered and carefully excluded by their location and their appropriate symptoms.

The mass of retained fluid sometimes reaches a bulk of 4 or 5 quarts, and by its great mass is puzzling.

Treatment of Retention.—The only treatment is the evacuation of the fluid by surgical means. To leave the patient alone, invites rupture. If the rupture is through the hymen it invites sepsis. Rupture through a Fallopian tube or rupture of the uterus would be dis-

astrous. Emmet is singular in saying that in this affection the uterus becomes thickened as in pregnancy; most reporters have found its walls thinned.

The patient to whom relief is not given surgically, suffers from pressure on pelvic viscera. The disturbance of the general health is very great. The fluid can not be absorbed, but, on the contrary, its mass continually grows greater.

The question of how much fluid should be drawn off, has agitated the surgeons for a long time. Emmet, following Dupuytren, drew it all off at once, and flushed all accessible genitalia with hot water until they were cleansed. It must be remembered that the fluid has only the colour of blood and lacks its antiseptic qualities, and that fact alone seems to justify the bold and complete operation. Puncture of the protruding hymen is a trifling operation, but the surgical technique should be as perfectly aseptic, and possibly antiseptic, as in the most formidable operations. One or more points of occlusion in the vagina may need to be torn open. Extreme care will be demanded in such a dissection, to avoid opening the bladder, rectum, or peritoneal cavity. Natural lines must be followed, not only to avoid these accidents, but to leave the greatest possible amount of epithelium on the raw surfaces. It has been found possible to make a vagina where there had been absolute atresia, the lumen being maintained by the prolonged wearing of a glass or rubber plug, and pregnancy and parturition have ensued.

Puncture or incision of the external os, the cervical canal, or the region of the inner os, should be done upon the same guiding principles.

In rare cases in which there was no uterus, but where fluid had accumulated from tubal menstruation, Braxton-Hicks and Haffner removed tubes and ovaries at a single operation by abdominal section.

Dysmenorrhœa.—Some rare cases of dysmenorrhœa, or painful menstruation, appear to be a manifestation of a general neuralgic tendency due to general neurasthenia. The very wide distribution of the pain—abdominal, sacral, and crural—suggests to the mind the theory of a general nerve storm, and it is upon this theory we rest when we can find no deformity or disease in the uterus or its appendages. We recall the anatomic facts that the nerve supply of the pelvic genitalia of woman is from the second, third, and fourth, sacral nerves; that the sympathetic fibres come from plexuses which are virtually branches of the aortic plexus, and that the aortic plexus is virtually a derivative from the semilunar ganglion and renal plexus on each side. The genitalia are therefore connected by no remote strands with the cerebro-spinal system and with all abdominal viscera, so that no great perturbation of the nervous system can occur without a disturbance of the genitalia. For pelvic pain at a menstrual time, bred by starving or irritated nerves in some remote part of the nervous system, the term dysmenorrhœa is inappropriate, for it does not appear that the

pain is due to menstruation. Menorrhalgia, proposed by Massey, is commendable in that it asserts pain, and nothing more.

By far the greater number of cases are due to some morbid condition of the generative organs. Turning to the uterus, we note, first, that the infantile uterus, with a depth of 2 inches or less, a conical cervix, and a pinhole os, is often a painful uterus at the menstrual time. The only explanation offered for dysmenorrhœa associated with the infantile uterus is, that the filaments of spinal nerves imprisoned in the embryonic stroma of the imperfect endometrium are compressed during the menstrual congestion and subsequent changes.

After pregnancy, when the uterus normally shrinks from pounds to ounces, the involution sometimes passes all bounds and leaves the patient with what is, to all intents and purposes, essentially an infantile uterus, by superinvolution. Here, again, we have dysmenorrhœa, and are again tempted to theorize as to the replacement of muscle by fibrous tissue and the incarceration of nerve endings.

There has long been a tendency to ascribe menstrual pain to the pressure of fluid which, by reason of partial stenosis at the inner or outer os, or at some point of flexure of the uterus, has an imperfect exit from the uterus and induces pain by hydraulic pressure. The old masters had high controversy on this head. Hewitt said, "The large majority of cases are really cases of retention." Sims said, "There can be no dysmenorrhœa, properly speaking, if the cervical canal be straight and large enough to permit a free passage of menstrual blood." The curative effects of cutting and stretching operations and the similar effect of parturition were held to confirm this doctrine. But, *per contra*, Matthews Duncan was prompt to contend that dysmenorrhœa was always neurotic in its origin; he pointed out that the pin-point os was large enough, as could be demonstrated on thousands of women; he urged that, in the absolute retention of menses, the pain was no greater than it was in many cases of dysmenorrhœa with free exit; he held it to be significant that girls in their first menstruation did not usually suffer much; he showed that the women who suffered most had less flow than others; he demanded an explanation of the fact that there was no distention or sacculation above the alleged stenosis. Others re-enforced him, declaiming that dilatation of the cervical regions cured dysmenorrhœa, only because the irritable fibres at that point were destroyed or paralyzed incidentally during the operation or during parturition. It was also shown that the uterine sound passed easily into the cavity during menstruation; that autopsies never showed stenosis at the site of a flexion; that the anguish was not extreme when in membranous dysmenorrhœa the membrane acted as a valve, temporarily, and arrested the flow. Confirming this negative argument came Handfield-Jones who declared that the os was normally open during menstruation, that it slowly closed in the next week and was tightly closed in the week before menstruation. He ascribed dysmenorrhœa to fibroid thicken-

ing, hyperæsthesia, and muscular spasm at the inner os. Williams, of Cardiff (*British Medical Journal*, October 24, 1897), extended these views in part to the higher regions of the uterus and suggested that the pain of dysmenorrhœa might be caused by abnormal contractions set up by diseased mucous membrane at the site of flexure.

Those who hold out for the obstruction theory admit that in flexion of the uterus there may be no stenosis demonstrable in the post-mortem specimen, but hold that, with the ante-mortem thickening and congestion, there may be a decided obstruction in life which no autopsy can reveal. The observation of Da Costa (*Obstetrical Society of Philadelphia*, December 5, 1889), that a flexion with a regular curve rarely causes obstruction, whereas a sharp bend does produce obstruction, is important in this connection.

Waiving all questions of the causal relation of obstruction, it must be admitted that a vast majority of cases of dysmenorrhœa are associated with anteflexion. It is very probable that this deformity is caused chiefly by an arrest of development in the anterior wall of the uterus, and a portion of the pain of menstruation may be due to causes which produce dysmenorrhœa in the infantile, or undeveloped, uterus.

Displacements of the uterus are associated with dysmenorrhœa, but not so frequently as flexions. It is a question whether the pain is produced by direct dragging on nerves or by an interference with the circulation at a critical time, or by setting up inflammation in the uterus or its appendages with adhesions.

Uterine tumours produce dysmenorrhœa. The general rule is that the more peripheral tumours, as subperitoneal fibroids, set up less disturbance than those which lie nearer the endometrium.

Metritis and endometritis are common causes of dysmenorrhœa. In its normal condition, the endometrium is almost, if not quite, as insensible as the cartilages and serous membranes, but, like these structures, it becomes exquisitely sensitive when inflamed. There is, in health, a certain sensitiveness at the internal os, giving the patient, usually, some uneasiness, or exciting strong reflexes when the sound is passed over this region; in inflammation, this sensitiveness is exalted into a capacity for excruciating agony at a touch. Metritis and endometritis interfere with every step in menstruation; from the beginning they cause pressure on pelvic vessels and nerves; the capillaries in the deep stroma become excessively congested and prematurely tear the epithelium away; the inflamed glands crowd and compress each other and retard amyloid or hyaline degeneration; and hyperplasia welds the deep and superficial stroma beyond the possibility of normal degeneration or regeneration. With all this irritation, we can not doubt that the uterine ganglia will become irritated, setting up contractions of muscular fibre which shall be either wholly abnormal or preternatural as to intensity. Handfield-Jones and others have shown the probability that there is

in all cases of menstruation a certain initial dilatation of the inner os, as at the beginning of labour before pressure or active dilatation has begun; if we grant this, we shall doubtless have the intermittent pains of the softening process aggravated many fold by the metritis or endometritis.

The connection of tubal disease or deformity with dysmenorrhœa is based upon very strong probabilities. The evidence is chiefly that the tubes are muscular; that they have motor ganglia capable of causing rhythmic motion in the tubes even after their severance from the body; that dysmenorrhœa is common among women who have salpingitis; that it is intense when a tube is obstructed at the uterine junction; that the tubes are continuous with the uterus and have the same nervous and vascular supply; and that they participate actively in normal menstruation.

Dysmenorrhœa from oöphoritis is wholly denied by some who say that the pain is merely referred to the ovary by the sufferer, when, in fact, it originates elsewhere. Nevertheless, there are very competent observers who have blamed certain severe cases of dysmenorrhœa on the ovary by a process of exclusion. Dysmenorrhœa is sometimes found to be associated with large, painful, easily palpated ovaries, so irritable that pressure upon them causes pain and nausea.

The study of chronic alcoholism in the female is sometimes confirmatory of the doctrine that inflammation of the ovaries may produce dysmenorrhœa; for dysmenorrhœa is often set up in heavy drinkers as a new symptom about the time the ovaries become large and tender.

Treatment.—No hope of relief for dysmenorrhœa caused by an infantile uterus could be extended if the uterus were not unique among the adult tissues in its marvellous degeneration and regeneration. It has happened repeatedly that that which has been correctly diagnosticated as a shallow, imperfect, undeveloped uterus, has become gravid and, mayhap, after repeated abortions, has been able to carry a fœtus to full term, and thereafter, reconstructed by normal involution, has maintained its proper adult condition. Only a few cases have this fortunate termination, and the prognosis is more gloomy in cases of superinvolution occurring in women of somewhat mature years.

The surgical treatment of uterine flexions is so treated in an appropriate part of this work, that its discussion as curative of dysmenorrhœa may be omitted here. But assuming that the flexions of the uterus are caused by defective development, one might well look to the hygiene of the adolescent girl as a prophylactic against the deformity. It is not going too far to say that the conventionalities of refined European and American life directly tend to undeveloped genitals in the young girl. The contrast between what is decent and proper among girls of our time and tribe, and girls living under savage conditions, is very great. The little children in many tribes of

savages are encouraged to attempt and to practise copulation until puberty, when, except among the most degraded, the girls are withdrawn from such possibilities. In many Oriental countries the girls are not only pledged in marriage in babyhood, but they are actually delivered over to their spouses before puberty. This is a very wide usage, also, among savages; it has been a source of horror and dismay to our red men that the girls sent to Government schools menstruated while at school, and the basis of this rage and astonishment is the Indian's conviction that menstruation at school is a sure sign that his little children have been debauched; for, so early do Indian girls enter into the marriage relation, that, as a rule, they do not menstruate until some time after they have found a place in the husband's lodge. Practices so repugnant to our notions of decency and morality seem most unnatural, and yet they belong to a state of Nature, and, whatever may be the decrees of fashion and civilization, there can be no doubt that the early sexual life, arousing rather than dwarfing the prophetic sexual instincts of girls, tends to develop the uterus. The free and licentious conversation of pastoral life, and even of agricultural life, in some countries, is doubtless a stimulant in the same direction, and these stimulants are forever withdrawn from our girls in the name of decency.

This must be so; but the mischief wrought by the young girl's dress is remediable. When her breasts begin to bud, the young American girl's shame of them is made a virtue by her mother, and while she cramps them up with a long and stiff corset, she jams all abdominal viscera down toward the pelvis by the same apparatus. Most girls say, and say truly, that the corset is not very tight; the mischief is done even by moderate pressure at the wrong place and in the wrong direction. A short and flexible corset, loosely worn, might be a beneficent thing by distributing the pressure of waistbands, while a long corset, stiff in front if not elsewhere, is a positive injury by transmitting pressure downward, by increasing constipation, and by interfering with the circulation in the uterus and its appendages.

The circulation in the uterus seems to be directly related to, and connected with, that of the lower extremities. It is the misfortune of the American girl that her legs are going into a state of disuse by reason of perfected artificial locomotion and elevators. As a matter of uterine hygiene, and as a provocative of uterine growth, she should walk much. Lawn tennis should be cultivated, and other games of the sort. Since it involves walking, one might even say a good word for golf. The bicycle used without excess is admirable. Housework, with its infinite variety of posturing, is to be commended. Horticulture, with its carrying and stooping and rising, is an ideal pursuit. Gymnastics might be scientifically prescribed for the legs and the whole body, but there was never yet a girl who, in dreary solitude, would practise bodily movements for the sake of exemption from vague and half-guessed pains in the far future, and,

for that reason, girls' gymnastics must incline to games, with something of excitement and rivalry and the exhibition of personal prowess.

Many girls have the feet habitually cold in summer, and in winter, so cold and numb as to be beyond the perception of suffering. It is very important that this state of arterial spasm should be broken up, for it is, as has been suggested, directly related to deficient blood supply to the pelvic organs.

When there is a marked flexion with dysmenorrhœa, the flexion must be dealt with on surgical principles laid down elsewhere in this work.

Stenosis, when it is believed to be a cause of severe dysmenorrhœa, should be dilated. The treatment is indicated whether it is held that mere obstruction is the cause of the menstrual pain or not, for in the latter case we have reason to believe that the stretching process interrupts unnatural and pain-producing channels of nerve conduction.

Extending his observations over 2,000 cases of marked dysmenorrhœa, Emmet found that about 75 per cent of them were sterile, and in this fact we find another reason for dilatation, for it will often happen that, after that operation has been thoroughly done, pregnancy ensues, and this, while a positive benefit incidentally, tends to the cure of dysmenorrhœa.

The choice will lie between gradual dilatation, which requires no anæsthesia and may be done at the consulting room, and rapid dilatation, which faces all risks of sepsis and inflammation once for all. In 1893, Goodell reported 400 cases of rapid dilatation with hot, antiseptic irrigation and gauze packing, and no untoward results, and, while others have not so enthusiastically advocated the operation, it is conceded that it is not a grave one.

In the gradual dilatation of tough strictures, electricity is of much assistance. A sound is insulated to within $2\frac{1}{2}$ inches of its tip and is passed into the cervix. When resistance is met with, a current of 10 milliampères will often cause the resistance to disappear in a few minutes. The treatment is completed by a current of from 20 to 50 milliampères for five minutes only. The sound will drop out easily and should be replaced by a larger one at the next sitting. The sound is, of course, connected with the negative pole and a clay electrode with the positive.

For the treatment of flexions and strictures by the cutting operations of Simpson, Sims, Dudley and Schröder, and for the modification of those operations the reader is referred to the appropriate chapters. The treatment in all cases seeks to amend any possible stricture and to interrupt the channels of painful nervous reflexes. Reference to other parts of this work is also made for the proper treatment of displacements of the uterus by tampon, pessary, or operation on the ligaments or upon the floor of the pelvis; for these surgical devices may need to be invoked for the relief of dysmenorrhœa.

Like reference must be made also for the appropriate treatment of metritis and endometritis.

The pain of dysmenorrhœa is much relieved by drugs which are not strictly anodyne, but rather antispasmodic. *Chloral* and *croton chloral hydrate* will control many cases. Some of the milder cases of pure neuralgic type will yield to a single sound sleep induced by *trional* or *sulphonal*. *Sulphonal* has a specially powerful sedative action on the lower portion of the spinal cord whence the uterus and its appendages receive their spinal supply. *Atropine* will relieve a certain number of cases, and seems to benefit those women most who never have warm feet or a blush of pink upon the general surface of the body. To be of use, the drug should be given in increasing doses for five days before menstruation, and it should be so managed that the face shall be flushed for one or two evenings. Most unfortunately, *alcohol* has a similar effect in like cases. As it breeds an indifference to small discomforts it is very seductive and should not be used.

Amyl nitrite may be used with good effect in cases where the pain comes and goes in waves. A few drops may be poured on cotton in a wide-mouthed bottle and the patient permitted to inhale the volatilized drug from time to time as the pain demands. *Cannabis indica* will mitigate the pain. Unfortunately, its anodyne effect is rarely produced until the patient is about to experience some disagreeable confusion as to time and space. *Gelsemium* is a drug much more available, yielding anodyne effects long before it produces diplopia. The depressant effects of the *bromides*, affecting the whole nervous system, should be borne in mind. In ordinary cases, the relief from pain under the bromides is too dearly purchased. *Camphor* yields surprising results occasionally, but is worthless in most cases.

Brisk eliminant treatment, with the administration of *salicylates of sodium*, *ammonium* and *lithium*, will so signally relieve certain cases as to reveal the gouty or rheumatic diathesis.

In all cases, and especially in these last, *acetanilide* will relieve the pain of menstruation. It is as valuable as any of the high-priced, licensed and patented "coal-tar derivatives." There is no good reason for combining it with alkalies or with caffeine, as in the popular secret mixtures. Like its chemical cousins, it is directly depressant and ultimately destructive to the most important elements of the blood or probably to the tissues, and its anodyne effect is produced by paralysis of nerve-endings. That it is a poison in all doses should be remembered, and it should only be used as a makeshift, or as antagonizing the rheumatic poisons. It is distinctly contraindicated in anæmic or debilitated patients. Cyanosis, sweating, and dark urine, show overdosing.

As an anodyne, an antispasmodic, and remotely as a hypnotic, morphine is an ideal drug in the treatment of dysmenorrhœa. Its deleterious effects upon the digestive tube are such that it should be reserved for emergencies. Nine out of ten female morphine habitués

have learned to use this seductive poison from its employment originally in the treatment of dysmenorrhœa. The physician who uses it should never name the drug in the presence of the patient, and the possibility of having a prescription refilled should be wholly forestalled. The active treatment of anæmia and chlorosis in the intermenstrual period will be the best treatment for dysmenorrhœa in many cases which have no pelvic disease or defect.

Fermentative dyspepsia is relatively common among dysmenorrhœics. It is sometimes necessary to treat this complication most actively. Active purgation just before menstruation has more than a palliative effect on dysmenorrhœa in some cases: it reduces pelvic congestion, and possibly assists in ridding the system of poisons which tend to neuralgia. Heat is an admirable palliative. Patients will usually suffer less when rolled up in a superfluity of blankets. Hot footbaths and sitz baths give an amount of relief which freshly shows the patient that congestion and pelvic pain are linked together. Great comfort is oftentimes obtained by chasing the sharpest pain from the sacrum to the abdomen, and back again, by the application of a bag of hot water.

Membranous Dysmenorrhœa.—In some cases of dysmenorrhœa the pain seems to be intimately associated with the appearance of a membrane in the form of a three-cornered pocket (Fig. 298), or of shreds and patches. In a very few cases the membrane gives a copy of the cervical canal.

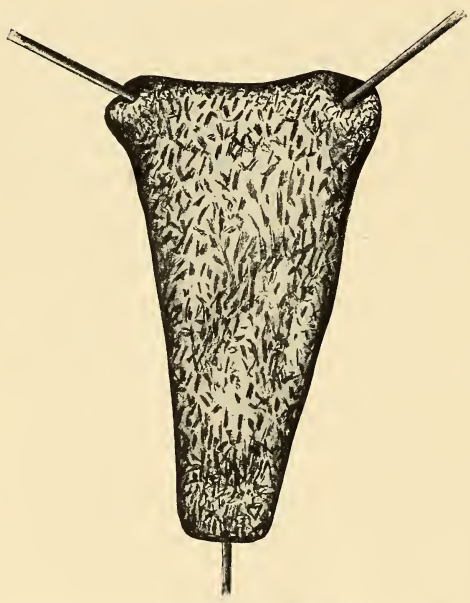

Fig. 298.—"A membrane in the form of a three-cornered pocket."—Millikin.

Some authors have held the membrane to be the result of a slight exaggeration of the normal process of shedding of epithelium; others hold it to be an exfoliation of the entire mucous membrane instead of its superficial layer; others see in it the plastic lymph of metritis organized; others, with less charity for unmarried patients, hold it to be the decidua vera of a pregnancy which has come to an early termination.

And there is a similar disagreement as to the immediate cause of the production of this membrane. Literature shows that it may be due respectively to flexions, versions, an os too small or too large, a constricted cervical canal, a constricted internal os, congestion of the mucous membrane, hypertrophy of the

mucous membrane, hypertrophy of the uterus, metrorrhagia, disease of the ovary, anæmia, chlorosis, syphilis, and hysteria. Nevertheless many of the subjects of the affection are exceedingly healthy women and some of them menstruate with so little pain as to make the term dysmenorrhœa inapplicable.

In the present state of our knowledge, it is safe to say that the characteristic exuviæ are the product of an endometritis of low grade. The membrane does not differ in any appreciable degree from that which is sometimes thrown off in cases of acute phosphorus poisoning, in typhus fever, and in cholera. It has been precisely imitated by severely cauterizing the interior of the uterus, for, following that procedure, there has sometimes appeared a three-cornered sac consisting of fibrous tissue "faced with a mosaic of cylinder epithelium." Schönheimer has had the opportunity of studying the membranes cast off by a woman who was sterile and had one thick tube, and he found nothing notable except fibrinous deposit full of leucocytes and uterine epithelium. In this case dilatation and curettage brought away normal endometrium.

Membranous dysmenorrhœa usually appears in early menstrual life. It may, however, appear later, to the dismay of the patient. Cook (*Chicago Medical Observer*, February, 1898) reports the case of a single woman, thirty-five years of age, who had often passed shreds of membrane, but who came under suspicion of pregnancy by passing a complete cast of the interior of the uterus while visiting. Under his observation she passed similar casts for two successive months. In Schönheimer's second case, the woman had borne six children without anything anomalous in her menstruation. After bearing these children she began to pass a uterine cast without pain at every third period.

The affection sometimes disappears as abruptly. Coughlin (*New York Medical Journal*, December 9, 1899) records the case of a virgin, thirty-one years of age, who passed the characteristic membrane with great suffering. She was under observation afterward for some time and had no recurrence.

The affection is exceedingly rare. Kleinwaechter made a collection of all accessible reports of cases and could only find 80 cases recorded (*Wiener Klinik*, February, 1885).

The membrane is seldom passed at a first menstruation. It is most common between twenty and thirty years of age. Nearly 80 per cent of cases recorded occur in married women. Relative sterility belongs to the disease; only 9.5 per cent of the cases in married women become pregnant. Pregnancy does not appear to be curative in any degree.

The *symptomatology* of membranous dysmenorrhœa is simply pain and the appearance of the membrane. The pain is not always severe, nor is it always promptly relieved by the appearance of the membrane. The flow is preternaturally great, though there are exceptions to this rule. The increased flow is explained by the facts, that there is a large surface suddenly denuded, and that the membrane, as soon as it

becomes a foreign body, acts as a stimulant and irritant to the uterus.

When membranous dysmenorrhœa has no history it will require a microscopic investigation to exclude abortion from the possibilities. After the affection has continued for some months, abortion is certainly excluded. Nevertheless there are some sterile women who, between shame and hope, will tell of 12 and 13 abortions in a year.

The *treatment* of membranous dysmenorrhœa by divulsion has not been satisfactory. Here and there, a nulliparous patient who passes large membranes, has received benefit. The *curette* usually brings away normal endometrium, and makes no impression on the next menstruation. Strong applications of *phenol, iodine, nitrate of silver, caustic potash* and *nitric acid* have been used with a vague hope of reconstituting the endometrium for the better; but it has been altered not a whit. Cauterant applications of electricity have not succeeded better. Gunning (*American Journal of Obstetrics*, April, 1891) reports a softening and disintegration of the membrane after a series of treatments by mild currents of galvanic electricity. He places the negative pole at the fundus and the positive pole just within the external os. His first current is as light as 5 milliampères. After a few *séances* the current is raised to 10 milliampères continued for five minutes and repeated every three days.

Intermenstrual Pain.—Intermenstrual pain is here considered because it has its relations to the menstrual period. Coming between the periods it certainly can not, in strictness, be allied to dysmenorrhœa.

Intermenstrual pain is referred almost invariably to one ovarian region or the other. In some patients, the pain changes from one side to the other from month to month. If there is an overflow of pain from the ovarian region, the iliac fossa, groin, and thigh, are affected. Sacral pain is not characteristic of this affection. No change of posture will alter the character or amount of the pain. The pain is distinctly paroxysmal and intermittent in character. The attacks are brief, lasting two, three, or four days, in most cases. Fever is not observed.

As to the time of attack, each case is a law unto itself. Palmer (*American Journal of Obstetrics*, 1892) reports a case in which the pain came on four days and a half after the cessation of menstruation, but this is unusual. In his second case, the pain appeared about eight days after the cessation, and in his third case, about eleven days after. William O. Priestley gives two cases in which the pain came on fourteen days before menstruation. Thomas and Mundé give cases in which the pain appeared at nine, ten, and seven, days after menstruation ceased. Some reporters vaguely speak of attacks covering four or five days in the middle of the intermenstrual period. One of Palmer's patients began to have the intermenstrual pain after confinement. She suffered ten years, then had an abortion followed by severe pelvic inflammation,

then, after a slow recovery, experienced some relief, the attacks becoming milder, shorter, and less frequent.

No *pathology* has been suggested for this curious affection other than that which attributes the pain to an ovary which, by the slow changes of inflammation, has become so dense as to make the passage of the ovule from the deeper layers a very difficult one. By hypothesis, there is some definite date for each woman, at which, measured from the close of menstruation, active preparation for the ripening and extrusion of an egg begins. This hypothesis involves the doctrine that pain is produced by tension about the growing follicle, and that the pain ceases abruptly when the follicle finally fights its way to the surface of the ovary and is free to ripen and rupture. The doctrine harmonizes the facts, that the cases do not present much uterine disease, that several of them at autopsy have shown dense ovaries, and that the patients are relatively, though not absolutely, sterile. Another and more tenable theory is that the pain is caused by ovarian adhesions which are placed upon tension by the periodical recession of the menstrual blood pressure, a recession which reaches its climax about the middle of the intermenstrual period.

Treatment is as inefficient as this pathology would indicate. Some have held that benefit was given by tampons of ichthyol and boroglyceride, and the great "alteratives," iodine, arsenic, and mercury, given for a long time. During the paroxysms, anodynes must be used.

Vicarious Menstruation.—If menstruation implies the casting off of endometrial elements, then the term vicarious menstruation can only be justified on the plea that it is convenient, for it certainly is inaccurate. The term vicarious hemorrhage has been proposed, but this is equally inexact in that it carries the implication that hemorrhage is an essential part of menstruation instead of a mere incident. We therefore use the older term, vicarious menstruation, arbitrarily, as indicating no more than hemorrhage which appears from some part of the body other than the uterus and in response to the menstrual molimen.

Though the cervix uteri has no part in ordinary menstruation, it is such a near neighbour to the uterus that we might expect it to be the source of vicarious discharges. Few cases are recorded. Ashton (*Philadelphia Medical Bulletin*, November, 1898) gives an account of a woman from whom he removed cancerous ovaries, whereupon she began to menstruate at the rate of four or five days every two weeks. He soon had occasion to remove the uterus close to the vaginal junction and closed the wound with peritoneum, whereupon she began to menstruate scantily from the cervix, every four or five weeks.

The tubes have occasionally presented at fistulæ in the abdominal wall, and in a large proportion of cases yield a red discharge at the time of menstrual molimen.

In ventro-fixation of any part of the pelvic organs after operation, vicarious hemorrhage has occurred. Thus, in 1884, Rein showed a

woman from whom he had removed an ovarian cyst and had fixed the pedicle in the abdominal wound. Healing had taken place promptly, but at one point there occurred a small slough just before menstruation, and from that sloughing point came blood during the whole catamenial period. This had occurred for three years.

The flow does not necessarily come from mutilated genitalia, but may come from other parts of the body, particularly from the mucous membranes. The nose is the most prone to vicarious menstruation. Macnaughton Jones reported (*Edinburgh Medical Times*, October, 1897) a case in which there was no epistaxis but in which a baffling nasal ulcer was conquered only after eleven months' treatment, and during the greater part of this time it was much worse at the menstrual periods. Withrow has reported 2 cases, already cited in these pages under Amenorrhœa, in which there was lifelong amenorrhœa and periodical epistaxis.

Periodical hemorrhage from the stomach has been diagnosticated as symptomatic of an ulcer at its onset. Charles T. Parks, of Chicago, reports a curious case of a woman who was sick for eighteen months, and for four months had defecated at intervals of from one to four weeks. For two months after coming under observation she failed to menstruate, and at the proper menstrual times she vomited torrents of blood. Her mental and physical condition became so bad that when fæcal vomiting came on, an exploratory incision was made. Enlarged ovaries were removed. Scybala in enormous quantity were expelled. The urine, which for four months had been reduced to one ounce *per diem*, rose to normal amount and recovery ensued.

Hemoptysis is sometimes due to the menstrual excitement. Norton (*American Journal of Obstetrics*, February, 1892) tells of a woman who menstruated from the age of fourteen, with much pain and cramps. At the very first menstruation she had a smothered or choking sensation followed by a coughing paroxysm during which she spat blood freely. This was repeated after a few hours and so continued until the fourth day, when the vaginal discharge was growing pink. From this time the bloody expectoration diminished to the vanishing point on the fifth or sixth day. She had a small uterus, high in the pelvis, with a minute os. Nevertheless, she became pregnant after five years of married life and, during her pregnancy, she continued to menstruate after her fashion, with vaginal discharge and bloody expectoration. The last menstruation was about ten days before delivery. During all the years that she was under observation she was a hysteric. Chadbourne (*Journal of the American Medical Association*, January 22, 1898) has made the important observation that many girls who have periodic hemoptysis, either synchronous with menstruation or replacing it, have incipient phthisis.

Sometimes the hemorrhage is from the ear. Lermoyez (*Société médicale des hôpitaux*) reported the case of a girl who had a periodic discharge of noncoagulable blood from the right ear. After three years

of this vicarious discharge, normal menstruation was established, whereupon the aural discharge appeared only once in two or three months.

Sometimes the weak point is found at a nævus. Bloom (*Archives of Pediatrics,* September, 1897) records the case of a girl, sixteen years of age, who bled from a nævus of the face. The hemorrhage came always two days before menstruation and lasted until the end. After two weeks there was another slight bleeding. Two teatlike projections furnished the blood. One of these being ligated, another appeared at the same site.

Many cases of bleeding cicatrices have been reported. Kerley presented to the New York Academy of Medicine, November 18, 1891, an Irish girl twenty-five years of age. At the beginning of her menstrual career at the age of fifteen, she developed an abscess at the level of the cricoid on the left side. From this point there had been a discharge of bloody pus four days out of every twenty-eight through the whole ten years. In each intermenstrual period the cicatrix healed.

Vicarious hemorrhage is most common from the nose. Next in order of susceptibility come the stomach and intestines. The hemorrhage has been observed to appear in the retina and under the conjunctiva. The vocal cords, the nipples, and the bladder, have also been the seat of vicarious bleeding. We have no philosophy for this remarkable phenomenon, save the doctrine repeatedly expressed in this chapter that the human organism has inherited, and has intensified, a strong tendency to hemorrhage at the menstrual time. So strong is the impulse that it is felt at remote points in rare cases. We can not rest upon mere increase of arterial tension, for though there is a slight increase of tension at the menstrual period, it is so slight that it becomes as naught when compared with other variations of blood pressure. A case reported to the *Indian Medical Record* by J. R. Wallace is instructive in this connection, for it indicates that Nature sometimes blindly confuses two discharges under the stimulation of the menstrual molimen. The subject was an Anglo-Indian lady who menstruated at twelve years and was married at twenty-three. She proved to be sexually impotent, incapable of orgasm, and, after enduring eight months of frigidity, her husband parted from her in disgust. Upon this ensued six years of amenorrhœa, but during these years, at regular menstrual intervals, her breasts would become hard and painful, and milk would pour from them freely. She had good general health and no pelvic pain. She laid on an immense amount of fat, increasing her weight from 98 to 245 pounds. At the end of this period of six years, Wallace adjusted an intrauterine stem and a slight discharge of blood was noted for three days. Four weeks later she had high fever, turgid breasts and resumed normal menstruation, and, at the time of the report, she had so continued to menstruate for six months. During this last period the mammary engorgement had diminished, and she had lost

28 pounds. It would appear that the brief irritation of the uterine stem had determined the direction of overflow for this singular case.

The Menopause.—The menopause, or the cessation of the menses, is an incident in the grand climacteric which comes to men and women alike, but comes to women earlier as a penalty for their earlier maturity. There need be no mystery as to its causes; when the genitalia have reached an age approximating half a century, it is proper that they should be subject to senile changes. When we consider the profound changes in skin, hair, arteries, Peyer's patches, the intestinal villi, and crystalline lens, at this time of life we are prepared to admit that the ovaries may be developing fibrous tissue and may be losing the power of producing ovules, and that the uterus, with its diminishing possibilities of gravidity, is also undergoing atrophic changes which are truly senile.

Making a mystery where there is none, some have assumed that during the menstrual years the ovaries secrete a certain substance which determines the menstrual flux and ministers to female health. Napier and Christopher Martin have held that this hypothetical substance being lacking at the menopause, gives rise to some of the symptoms of the climacteric. But it should be remembered that shoals of men, women, and children, live in health without active ovaries, or with none at all, yet have good health, and that the climacteric is not a pathologic process or the menopause a symptom.

The vulgar rule which gives to each woman thirty years of menstrual life allows her too little. The menstrual career is more than thirty-one years. Raciborski found that Parisian girls menstruated first at about the age of fourteen years and seven months, and that the women ceased menstruating at forty-six years and six months. Tilt, upon knowledge of more than a thousand cases, comes to almost identical figures. There is no doubt that, within the past two generations, civilization has increased the menstrual period as it has lengthened life.

When the menopause is accomplished early in life, it has sometimes been found at necropsy that atrophy of ovaries had advanced, and in some cases hard, subperitoneal fibroids have been found. Tumours which have a mural or submucous situation tend, in general, to maintain the menstruation to the age of fifty, or beyond that.

The uterus is said to become a trifle larger and heavier at the beginning of the menopause. Whether this is true or not, it is certain that the tendency is presently toward atrophy. The walls become demonstrably thinner; the cervix becomes shorter and thinner; the os internum is sometimes obliterated; the uterus is smaller in all dimensions; the endometrial glands become smaller, and their numbers diminish.

The rule is that the uterus atrophies later than the tubes and ovaries. A competent observer has found the ovaries of normal size

three years after the menopause, and it is known that ovulation is often prolonged for years after the uterus has ceased its functions.

Changes in the ovaries at the time of the menopause have been studied by Otroschkevitch (*Vratch*), who has come to the following conclusion:

"The lessening of both ovaries in old age arises in connection with increased growth of fibrous connective tissue and the predominance of this over the degenerating follicles. The disappearance of the epithelium covering the surface of the ovaries which occurs in old age can not always be put down to separation during preparation of microscopical specimens, but must rather be taken as one of the true changes in the senile ovaries. Desiccation of mature and wholesale degeneration of the primordial follicles forms one of the chief and most important changes in senile ovaries. Hyaline degeneration of the arteries and fibrous tissue progresses with age, and in very advanced age striking examples of this degeneration are found. Fatty degeneration of the cellular skeleton occurs fairly often, and is evidently dependent upon the deficient nutrition of the ovary. A direct connection between degeneration of the vessels and diminution in function of the ovaries is not substantiated, for the ovary becomes limited in function when there are still but few vessels affected by degeneration and therefore at a time when its nutrition is but little altered. The nervous system plays the chief part in the complex process."

At the menopause, women, like men at a corresponding age, suffer from a deposit of fat which is oftentimes a serious burden. The masses deposited in the abdominal wall and in the omentum are absorbed in great degree in later life, or, as some think, are simply redistributed. The mesentery, also, takes on a large amount of fat. About the heart, in the pericardium, and in the subpericardial connective tissue, the accumulation of fat becomes very embarrassing, leading to such serious symptoms as hurried respiration, cardiac asthma, cardiac palpitation, venous stasis, and, in the worst cases, to albuminuria and œdematous feet and legs.

About one woman in ten will be annoyed while at the menopause, by flashes of heat running over the face and neck, and sometimes sweeping over the whole body. The heat is a subjective sensation and is not real. The sensation is caused by a temporary vasomotor paralysis which permits the extreme dilatation of the small vessels. Sometimes profuse sweating follows these waves.

Metrorrhagia has no place among the normal phenomena of the menopause. It occurs rarely, though the folklore of the women keeps them dreaming of torrents of blood at the change of life. Scanzoni himself endeavoured to explain the profuse hemorrhages of the menopause by assuming a great friability of the blood vessels, and Kisch has taught that the softening and relaxation of the uterine substance is the cause. But, as a matter of fact, their theories are superfluous,

for hemorrhage is not an incident pertaining to the menopause. Metrorrhagia, when it does occur at that time of life, is usually induced by some one of the ordinary causes which we have enumerated elsewhere. Baer (*American Journal of Obstetrics*, May, 1884) has analyzed 2,200 cases of metrorrhagia, and shows that the profuse hemorrhage belongs to the early years of greatest fecundity and to any period of menstrual life rather than to the menopause. In five years following the age of twenty-nine there were 364 cases; in five years following the age of thirty-four, 333 cases; in five years following the age of thirty-nine, 223 cases; in five years following forty-four years, 131 cases. In the years between twenty and forty there were 1,533 cases, and there were only 667 cases for all other ages.

It is at the menopause that inhibition fails and lurking cancer advances by leaps. Any metrorrhagia at this time of life should excite suspicion of cancer. A serous discharge is sometimes the warning of cancer, and sometimes of senile endometritis.

With the atrophy of the hypogastric plexus come some disturbances of the sympathetic nervous system, though the reflex disturbances of the stomach and intestines at the menopause have certainly been exaggerated in medical literature. The dyspepsia of this time of life is not peculiar to females. Many alert practitioners have worked through a lifetime without seeing the alleged diarrhœa of the change of life.

The heart is more disturbed at this time than, perhaps, any other organ. By far the larger number of cases of tachycardia in women appear at the very first announcement of the menopause. It is a noticeable fact that tachycardia is most likely to afflict those who experience the menopause early in life. Few cases have come to autopsy, but those few have almost invariably confirmed the theory that the tachycardia belongs to the exceptional cases in which there is early shrivelling of the ovaries with hyperplasia of connective tissue, and it is a part of the theory that the nervous reflex, doubtless a stimulation of the accelerators, proceeds from the cirrhotic ovaries. Tachycardia is also common in cases in which the operations on pelvic organs have caused adhesions. Tachycardia should be carefully distinguished by the strong, full, regular pulse, the irritable disposition, the throbbing aorta, the constriction of the chest, and the high percentage of hemoglobin, from the weak heart, announced by a weak and fluttering, easily compressible pulse, and the low ratio of hemoglobin which accompanies this sort of debility.

Glycosuria is sometimes present in the years about the menopause. The prognosis is not so grave in these cases as in glycosuria in general, for the theory of causation permits us to believe that the disease is produced by irritation of the sympathetic supply of the liver, and permits us to hope that when the immediate nervous irritation from ovaries and uterus shall have ceased by atrophy, there will be a tend-

ency toward recovery. In many of these cases of glycosuria, vulvar pruritus is the danger signal.

Early in the menopause there is sometimes noticed a curious mental exaltation. While it lasts the woman becomes inclined, perhaps, to meddle with business affairs which concerned her not in earlier life; she has large plans; she essays large tasks; she proposes for herself all that is difficult or impossible. It is a state of mind which does not last long.

Far more frequently, the mental condition of the menopause is one marked by depression. The sane woman at the change of life is one who, as a rule, suffers depression rather than mental exaltation. If the perturbation of the time drifts into a positive mental alienation, it is likely to take the form of melancholia and hypochondria, and passive forms of hysteria. Not that more active forms of insanity are excluded. At this period may appear strong irresponsible impulses, active moral perversions, delirium and acute mania. Of these, and of all sorts of insanity, it may be said that the prognosis is good if there are not too many neurotic defects in the ancestry.

At the menopause, that which seems to be an insanity or a radical change of character, newly acquired, is, upon close study, seen to be merely an exfoliation of mental habits formed in the best years of life. Thus stripped, the patient returns to her earlier mental condition revealing traits which were suppressed through her young womanhood. In one woman we may see something of childlike trustfulness and pliability appear; in another, disagreeable childish traits appear when the veneer has been peeled off; and she who was tidy is slovenly in her house or her person, becomes stubborn about small matters and is absolutely frivolous in conversation and in behaviour. Addiction to alcohol and other nerve-tickling drugs sometimes becomes pronounced at this time, and the demand for these drugs seems to have no other basis than childish ennui and a babyish lack of self-control. The patient, no longer busy in life, no longer self-centred, can not abide solitude and relies wholly on company. She becomes exacting in small matters, and jealous, not of her husband alone, but of all upon whom she has claims. It is a curious fact, and fortunate, that many such cases, having fallen into this advanced senile state, will work out of it again and go through many years of later life sane and serene.

No doubt we pay too much attention to the physical changes accompanying the menopause and too little to the tremendous mental change which comes to every woman at that period of life. A man grows old by merciful and gentle gradations, and so he slides, half willingly, and half unconsciously, into the afternoon of life, with regrets so soft that they can scarce provoke a sigh. But for a woman, man's twenty years of gentle change are compressed into two; she is rudely compelled to make an abrupt change of mental attitude as regards life and love, and the big world and the great future. It is

evolution for him; it is revolution for her. She is suddenly brought to perceive that her charms, her youth, her sex itself, are passing from her. She is invited, with cruel abruptness, to be to her husband merely an intellectual companion or a sexless helpmeet, when she has been of late the object of his embraces and the mother of his babes. One third of her adult life is still before her, full of promise of placid enjoyment and great usefulness, but to her, remembering the glory of conquest and surrender, the future stretches a dreary waste of empty years.

It appears small wonder, therefore, that, with this sudden violence done to lust and love and pride and hope, the woman at the climacteric, finding a sharp boundary set to her warm young life, beyond which she must walk into a gray and passionless old age, should be the victim of a sadness which may drift into a melancholy and so into a madness. The explanation of the psychoses and the neuroses of the menopause is not to be sought in absolute senility, nor in the accumulation of menstrual poisons, nor in the lack of ovarian juices, so much as in the suddenly changed mental atmosphere of her who stands reluctantly between youth and age, bereft of all that she most valued in herself.

Treatment.—The menopause, itself, needs no treatment. But since it is a season of nervous depression, and a time when the vital powers are failing, latent diseases and defects, hitherto well borne or suppressed, assert themselves.

The gouty diathesis or the rheumatic taint may demand treatment by elimination, regulated diet, and prescribed muscle waste. A syphilis may need a course of treatment after it has been forgotten for years.

Perineal and cervical lacerations, hemorrhoids and varices, may cry for attention, not merely because the menopause is at hand, but because the woman is no longer young, and repair is slow, resisting power is lessened, and inhibition by the higher centres over the irritated lower centres is withdrawn in some degree.

Climacteric fat may become a burden so grievous that the ingestion of hydrocarbons must be restricted, drink must be limited, and vapour baths and physical exercise must do the rest.

Dyspepsia, diarrhœa and constipation may be so extreme as to be interpreted as manifestations of profound disturbance of the sympathetic supply of the intestines by an irritation proceeding from the genitalia. At this time, errors of diet and regimen will tax the patience of the physician who would detect and correct them.

The circulatory disturbances of the menopause are mostly affections showing stimulation of the accelerators. Digitalis is much abused in these cases. Veratrum viride is more indicated when a sound heart is to be dealt with.

The heart is not involved in the curious flushes and subjective flashes of heat. The bromides, used with due regard to their depress-

ing effect, will yield very good results in these cases. Many women, when they are made to understand the nature of these sensations, do not care to have treatment for them.

Insomnia is a very troublesome symptom of this time of life, and will demand careful treatment. The patient may take a certain amount of hypnotics, but always with the knowledge that they are great evils, introduced only for emergencies, and that the main remedial agents must be open-air life, moderate fatigue at bedtime, a mind at rest and plain food. The attendant who is justified in the occasional use of hypnotic medicines will do well to keep his own counsel, and never permit the name of the drug to cross his lips, attributing each sound sleep to anything other than the drug he has used. If his wakeful patient becomes his confidante he will find himself unable to baffle her when she sets herself to use drugs for the induction of sleep at her own pleasure.

Tachycardia, mild or severe, occurring at the menopause, will usually end in recovery when the ovaries have had time to lose their nerve elements and have ceased to tease the sympathetic system. The cases in which there is a dilatation of the heart do not tend to recovery, though they usually improve after the patient has ceased to menstruate for some years. Plainly, the source of irritation is not always in the contracting ovaries; tachycardia has, in rare cases, come to an end after the removal of cicatricial tissue at a laceration of the cervix.

In some few cases with great nervous fretting and poor nutrition, a period of rest and seclusion away from home may avert absolute insanity. This treatment, with high feeding, is indicated especially for women who have long been overworked. The beneficial effects upon the thoughtless or deliberately cruel home people is sometimes the chief justification for sanitarium treatment. There are many patients, on the other hand, who are in danger of grave psychoses because they have nothing to do, and it may be possible for the physician to suggest some avenue through which the patient may find her way to useful work, renewed zest in life, and some promise of a mind at peace. Certain it is, that mere drug therapy can avail little for those who are overworked or for those who have no occupation.

CHAPTER XLVII

THE FEMALE URINARY APPARATUS

Physical examination—Catheterization of the ureters: Pawlik-Kelly method; use of the ureterocystoscope—Harris urine segregator—Anomalies of the kidneys in number, location, form—Movable kidney, etiology, pathologic anatomy, symptomatology, treatment—Anomalies of the ureters—Stricture of the ureters—Nephrocystosis: Nephrydrosis; nephropyosis; pathologic changes, symptomatology and diagnosis, treatment.

Physical Examination.—In all examinations of the kidney, the abdomen should be thoroughly exposed by the removal of all clothing. The examination may be made with the patient lying on the back, on the side, or standing. When on the back, the shoulders should be slightly raised and the limbs drawn up to relax as much as possible the abdominal muscles. With the palmar surface of the fingers of one hand, counter pressure is made posteriorly just below the twelfth rib, while the other hand presses upward and backward beneath the costal arch external to the rectus muscle. The patient should now take a deep breath, and during the expiration, the anterior hand should follow the receding abdominal wall. The kidney, if it descends far enough, may be grasped between the hands and its surface easily palpated.

In the side position, the patient lies on the side opposite the one to be examined. The body should be curved slightly forward and the limbs drawn up. In this position the kidney, if movable, drops toward the middle line and may be more easily felt.

The standing position is to be preferred when examining for "palpable" kidneys, for "movable" kidneys of low degree, or when the superior pole tilts forward. The body should bend gently forward with the hands resting on a table or chair. The kidney can often be palpated in this position when it can not be felt lying down. The kidney is recognised as such by its shape, its range of motion, its relation to the colon, and its return to the normal location by manipulation or position of the body. The shape can not be better expressed than by the well-understood expression "kidney-shaped." The range of motion of the mass is of considerable diagnostic value. In movable kidney, the range of motion is usually through an arc of a circle, the vessels forming the pedicle representing the radius, while the origin of the vessels corresponds to the fixed point or centre. The majority of

movable kidneys pass below the transverse colon and behind and to the inner side of the longitudinal colon. When the superior pole tilts forward, the rounded end may be felt just below the edge of the liver and above the transverse colon. It may resemble very much an enlarged, distended gall bladder, and diagnosis is often difficult. The diagnostic points, aside from the history, are these: The kidney may usually be felt with the hand behind as well as in front, which is not often the case with the gall bladder. The kidney may be returned to its normal location by manipulation or when the patient lies down, the tumour disappearing; while though the gall bladder, if it has a long mesocyston, may be crowded back under the liver thus partially disappearing, it tends to return forward to its normal position so soon as the pressure is removed. A so-called "Schnürlobe" of the liver may closely simulate a movable kidney, but its connection with the liver can usually be made out.

Very small tumours may rarely be detected in palpable kidneys by the slight irregularity or protuberance produced on the surface of the organ. Tumours of the kidney that are of sufficient size to form distinct enlargements, can usually be outlined without much difficulty. One of the most important diagnostic points in connection with these tumours is the relation that they bear to the longitudinal colons. As the kidney lies in the retrocolonic space, enlargements of it from whatsoever cause displace the colon forward, forward and inward, or inward. Deviations from this rule are the exception, and occur usually in enlargements of movable kidneys. The relation of the colon to the tumour can always be easily determined by having the bowel thoroughly emptied; then the tumour should be mapped out on the surface of the abdomen and the colon gently distended with air by means of an ordinary rubber hand bulb. Having decided that a tumour is connected with the kidney, it is next desirable to know if it is solid or cystic. This can often be determined by the sense of touch and the presence or absence of fluctuation. At times, however, fluctuation is so doubtful that one is unable to decide. In such a case, the aspirating needle may be used with the usual aseptic precautions. It should always be introduced posteriorly so that the peritoneal cavity may not be entered. Should fluid be withdrawn, its character will determine the nature of the enlargement, whether simple cyst, nephrydrosis, nephropyosis, echinococcus, etc.

The surface of the tumour should be palpated to ascertain if it is smooth and uniform, or irregular and nodular. Of the former class, are the simple cystomata and usually the large rapidly growing "mixed tumours" of childhood. Of the latter, are congenital multiple cystic kidney, infected kidneys with multiple intranephric and perinephric abscesses, and some malignant growths.

Tumours of the kidney are usually movable, particularly during their early stage. Later, they may become fixed by adhesions to surrounding parts. A careful examination of the urine is of great im-

portance in the diagnosis of renal diseases. In order to determine accurately the point of origin of pathologic products in the urine, it may, at times, be necessary to collect the urines directly from each kidney separately. This may be done by catheterizing the ureters or by the use of the Harris urine segregator.

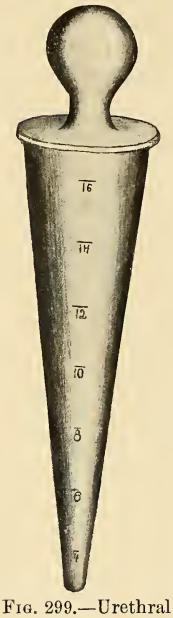

Fig. 299.—Urethral dilator.—Harris.

Catheterization of the Ureters.—There are two methods at present in use of catheterizing the ureters. These are the Pawlik-Kelly method and the use of the ureterocystoscope.

In the *Pawlik-Kelly* method the instruments necessary, as given by Kelly, are the following: A conical urethral dilator (Fig. 299); several specula with obturators (Fig. 300), Nos. 8, 8½, 9, 9½, 10; a light; a head mirror; an evacuator; long recurved mouse-toothed forceps (Fig. 301); a ureteral searcher (Fig. 302); flexible ureteral and renal catheters; a metal ureteral catheter; hard-rubber bougies, and a series of dilating catheters. The bladder should be completely emptied of its urine and the patient placed in the knee-chest position on a table. The urethral orifice should be cleansed with a boric-acid solution, the urethra dilated, if necessary, with the conical dilator, and a properly sterilized speculum, No. 8, 9, or 10, introduced into the bladder. Upon withdrawing the obturator the bladder immediately distends with air. The vagina, likewise, usually distends with air, but when it fails in this, as is likely in the virgin, it may be necessary to introduce into the vagina a very small cylindrical speculum or one of the urethral specula, when the air will readily enter and the speculum may be withdrawn. The light is now reflected from the head mirror into the bladder, illuminating it so that its interior may be readily examined. The speculum is withdrawn until the internal end of the urethra begins to fold over it. Now, by pushing it straight in for a distance of about 1 centimetre, and then deflecting it laterally about 25° or 30°, the ureteral orifice usually comes into view. This has

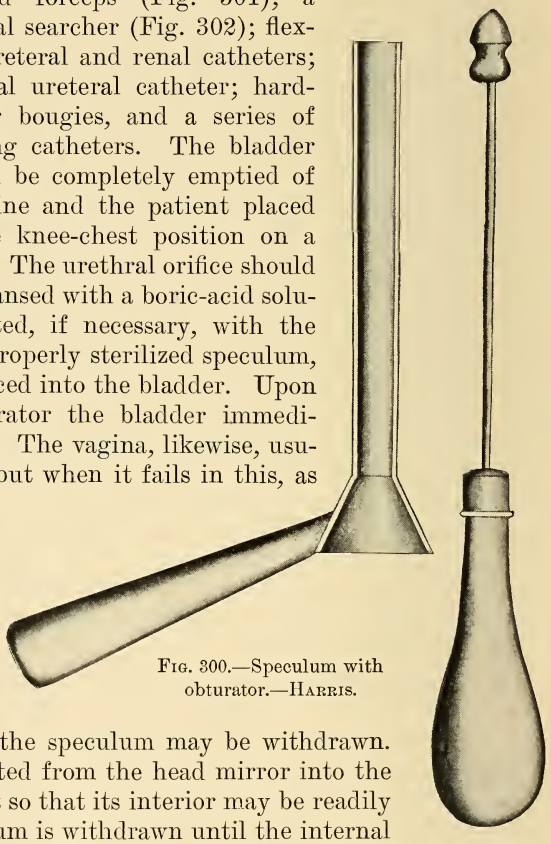

Fig. 300.—Speculum with obturator.—Harris.

the appearance of a small narrow slit, a slight elevation or papilla, or sometimes of a small fold in the mucous membrane. If the ureteral orifice does not readily present itself after the end of the speculum has been directed to the location where it presumably ought to be, it may be sought for with the searcher. When found, it should be carefully wiped off with a piece of cotton wet in boric-acid solution, and the catheter gently introduced. If desired, the speculum may be withdrawn, the patient turned on the back and the catheter allowed to remain until sufficient urine has been collected for analysis.

Fig. 301. Mouse-toothed forceps. —Harris (page 746).

The chief advantages of this method are that the instruments necessary are simple and inexpensive, and that it permits cleansing of the ureteral orifice by direct application before introducing the catheter. The method, however, is not so simple as it appears. Much practice and dexterity are necessary, and numerous failures will be recorded by the occasional user. Besides, an anæsthetic is often necessary in order to secure perfect ballooning of the bladder, when two trained assistants or a special apparatus will be required to hold the patient in position.

Catheterization by Means of the Cystoscope.—By this method the catheter is introduced into the ureter under the guidance of the eye by means of one of the ureterocystoscopes, such as Casper's, Nitze's, Albarran's, Brenner's, etc. (Fig. 303). The bladder is thoroughly cleansed by irrigation, and about 100 to 150 cubic centimetres of clear boric-acid solution allowed to remain in the bladder. The cystoscope, properly sterilized, is then introduced, and the interior of the bladder illuminated by the electric light. The ureteral orifice is sought for by inspection, and, when found, the catheter, passed along the small canal in the instrument, is directed toward, and made to enter, the ureter by the sense of sight.

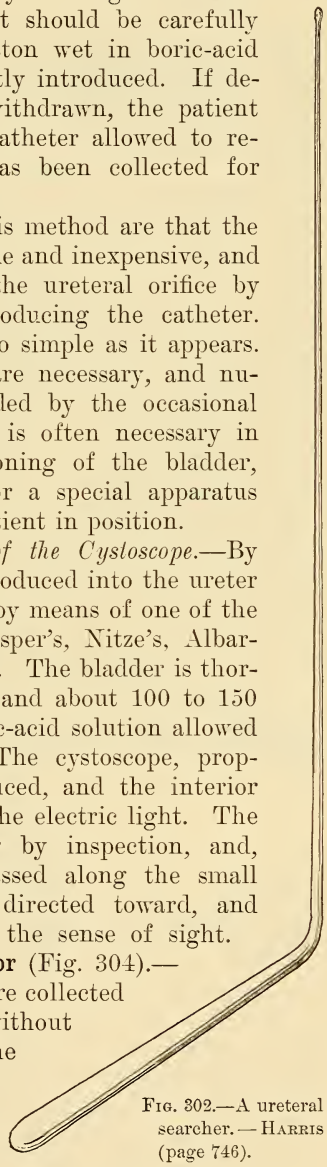

Fig. 302.—A ureteral searcher. — Harris (page 746).

The Harris Urine Segregator (Fig. 304).—By this instrument the urines are collected separately from each kidney without the ureters being entered (Fig. 305). The patient is placed on the back in an easy lithotomy position with the hips on the same level as the shoulders. The bladder, after being thoroughly cleansed by irrigation, is distended with about 150 cubic centimetres of sterile water. The double catheter, sterilized by boiling, is introduced into

the bladder and the lever into the vagina. After these two pieces are locked by means of the small pin in the forked piece, the catheters are opened and fastened by means of the small spiral spring. The rubber tube connecting the curved tips of the catheters is now removed and

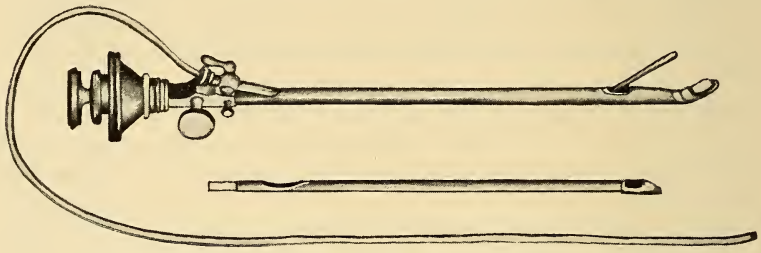

Fig. 303.—"One of the ureterocystoscopes."—Harris (page 747).

the water within the bladder allowed to escape. The vials are attached and, by means of the most gentle action of the bulb, the urine will be found to collect in the vials, right and left respectively, as fast as it escapes from the ureters. Each of these methods has its advantages. By means of the cystoscope, the interior of the bladder may be accurately inspected, and local conditions, such as inflammatory changes, ulcers, incrustations, new growths, etc., recognised. By catheterization of the ureters the urine may be collected and the pelvis of the kidney drained and then treated by irrigation. The use of ureteral bougies will often enable one to recognise the ureter more readily in certain operations in the pelvis, or to locate the divided ends of an injured ureter. One may be able to detect the presence and location of a stricture or obstruction of the ureter, possibly to dislodge a calculus from the ureter, and rarely to detect a calculus in the pelvis of the kidney. The great disadvantage of the ureteral catheter is the danger of infecting a healthy ureter and kidney. This danger is so real that, in the presence of a septic bladder, or in tuberculosis of the bladder or of one kidney, a healthy ureter should never be catheterized except under the most urgent necessity.

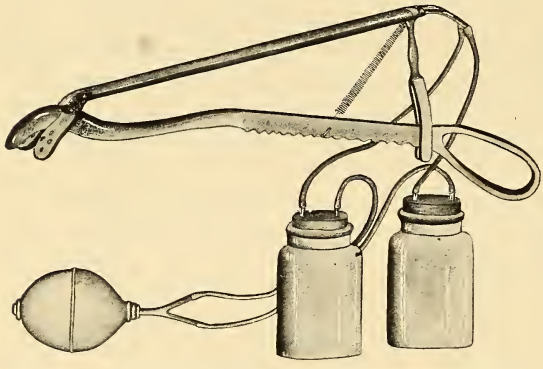

Fig. 304.—The Harris urine segregator.—Harris (page 747).

The great advantage of the urine segregator is that it may be used without danger of infecting a healthy kidney, even if the bladder is septic, as the instrument does not enter the ureteral openings.

Anomalies of the kidneys may be considered under three heads: (*a*) *Anomalies of number;* (*b*) *Anomalies of location;* (*c*) *Anomalies of form.*

Anomalies of Number.—Absence of both kidneys has been observed, but the condition is incompatible with prolonged post-natal existence.

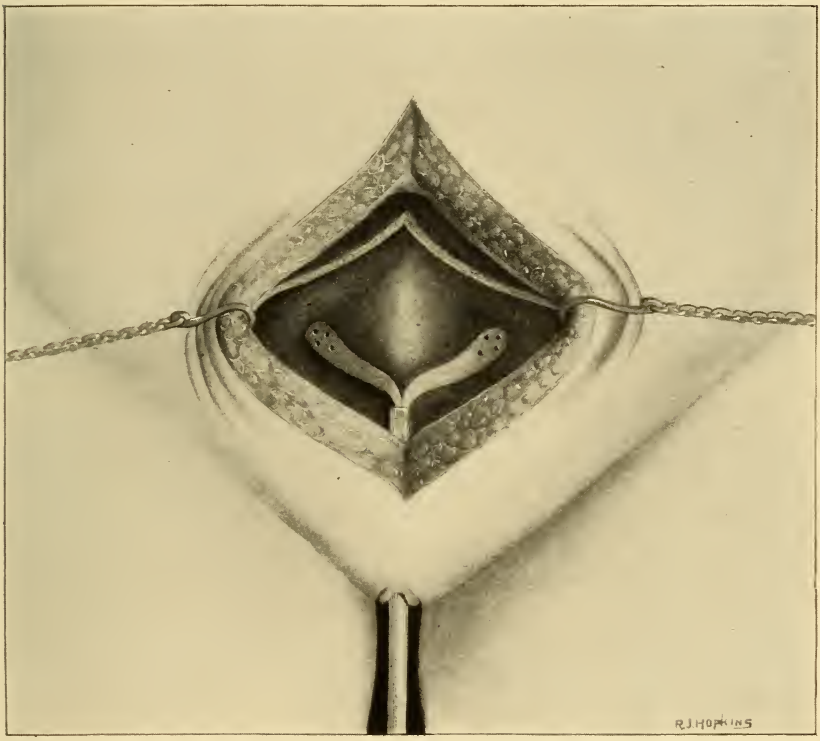

Fig. 305.—"By this instrument the urines are collected separately from each kidney without the ureters being entered."—Harris (page 747).

Absence of one kidney, provided the other is normal, is perfectly compatible with health and existence to old age. This condition is found in one individual in about 3,000, and is thus of considerable surgical importance. The remaining kidney is called a "single" or "solitary" kidney.

Ballowitz (*Archiv für pathologische Anatomie*, Bd. cxli) has collected 213 cases of "single" kidney. The left kidney was absent 70 times, and the right, 42 times, in males; the left, 31 times, and the right, 34 times, in females. Remainder unstated. While in men the absence of the left kidney distinctly predominates, in women, the two sides are about equally represented.

With absence of a kidney is frequently found some developmental defect in the generative organs of the same side, such as absence of

the ovary and tube, and uterus unicornis in women, or absence of the seminal vesicle, vas deferens, or testicle, or unilateral prostate, in men. In 71 women, such defect was found 41 times, while in 113 men, it appeared only 28 times. A "single" kidney is almost always larger than normal. In 116 cases, the kidney was distinctly hypertrophied, while in only 5 cases was it found smaller than normal. Nephrydrosis, chronic inflammatory, or other pathologic changes, were found in nearly 12 per cent of Ballowitz's 213 cases. "Single" kidney has been unwittingly removed a number of times for disease, with the inevitable death of the patient as a result. In all cases, therefore, in which nephrectomy is contemplated, the possibility of "single" kidney must first be excluded. In "single" kidney, almost always but one ureter is found opening into the bladder, and this is of great diagnostic importance, but in 4 cases, 2 ureters were found opening into the bladder at their normal locations, the one leading to the kidney, the other forming only a shorter or longer blind tube. "Single" kidney usually occupies the normal location on one or the other side, but may be displaced as described under anomalies of location.

A few cases have been described in which three kidneys were said to be present. Most of them were probably cases in which one kidney had become subdivided into two portions by a deep furrow extending entirely through it, the two portions becoming somewhat displaced from each other, and the ureter from each soon uniting to form a common ureter. Cheyne (*Lancet*, 1899, vol. i, p. 215), however, describes a case of a woman on whom he operated for a movable tumour situated to the right of the middle line. Upon opening the abdomen the tumour was found to be a movable third kidney with its own ureter and blood supply. It lay near the pelvic brim from 3 to 4 inches from the normal right kidney, which was present. A left kidney, somewhat smaller than normal, was present in the usual location.

Anomalies of Location.—The kidney may occupy any position from the normal above, to within the pelvis below. Both kidneys may occupy the same side of the body, lying one above the other. The ureter of the misplaced kidney usually crosses over to its proper side where it enters the bladder at the normal place. The most common misplacement is at, or near, the brim of the pelvis, over the sacro-iliac joint, or just within the pelvis. Of 76 collected cases of pelvic misplacement, the right kidney was misplaced 12 times, and the left 64 times. The ureter is shorter than normal, according to the degree of misplacement, but enters the bladder at the usual point. The blood supply is derived from the aorta near its point of bifurcation, or from one or the other iliac arteries. The kidney is usually fixed, and somewhat flattened from before backward. When in the pelvis, the kidney may be the cause of dystocia by preventing the engagement of the head. In such a case, Cragin did a vaginal nephrectomy under the supposition that it was a tumour causing the dystocia. Goulliund

operated on a pelvic kidney under the mistaken diagnosis of interstitial salpingitis. Misplaced kidneys may be the seat of pathologic changes.

Dartigues operated on what he supposed to be a cyst of the mesentery, but found a case of nephropyosis in a kidney misplaced in the mesentery of the small intestine. Such cases have only been diagnosticated at or after the operation, but in all cases of unusual tumours in the pelvis or about the pelvic brim, the possibility of a misplaced kidney should be considered. In misplaced kidney, the adrenal does not usually accompany the kidney but remains in its normal location.

Anomalies of Form.—The kidney may retain its fœtal lobulated form, deep fissures, often extending to the pelvis, separating the lobules.

The most important anomaly of form is the "fused" kidney. In this condition the two organs are united, the degree of union, or fusion, varying from the simple horseshoe kidney to almost complete fusion into one organ. In the variety called "horseshoe" kidney, the two organs lie one on either side of the vertebræ, their lower poles being connected by a band of tissue called the isthmus, which extends across the vertebræ in front of the aorta and vena cava. The isthmus may be composed simply of a band of connective tissue, or it may contain kidney tissue. It may be quite long, or the lower poles may be fused directly together, in which latter case a connective-tissue septum usually separates the kidney elements belonging to one organ from those belonging to the other. The pelves are usually directed more anteriorly than normally, and the ureters pass in front of the isthmus. Rarely, the isthmus extends between the upper poles instead of the lower.

The fused organs may both lie on the same side of the body, in which case the lower of the two is the misplaced organ. The lower pole of one fuses with the upper pole of the other, with the pelves looking in opposite directions or in the same direction. Almost all degrees of fusion may take place, but the pelves usually remain completely separate and distinct, each having its own pyramids and tubules supplying it, and each having its own ureter. One half of a fused organ may be the seat of pathologic changes, while the other half remains normal, a fact of considerable surgical importance. Abnormities in the blood supply are almost always present. Fusion does not appear to predispose to disease. According to McMurrick (*International Journal of Surgery*, 1898, vol. xi, p. 335), 40 per cent of the fused organs were on the right side and 60 per cent on the left; 78 per cent occurred in men and 22 per cent in women.

Under the anomalies of form, may be mentioned the "suppressed," or congenitally small kidney. In this case the kidney has been arrested in its growth so that often but a remnant of the organ is found. A "suppressed" kidney may secrete urine of normal composition, but in quantity insufficient to maintain life should the opposite organ require removal.

Movable Kidney.—The kidneys, although classed as fixed organs, move up and down with respiration, the normal range of motion varying from 2 to 5 centimetres in a longitudinal direction. As a rule, the normal kidney can not be palpated through the intact body walls in men, but in women the right can be distinctly felt in a majority of the cases, and the left in a much smaller proportion. The extent to which the kidney may be felt, varies from the lower third to the major portion. It is best sought with the person standing, the body bent slightly forward so as to thoroughly relax the anterior abdominal muscles. The volar surfaces of the fingers of one hand should be pressed firmly against the loin beneath the twelfth rib, while those of the opposite hand are crowded upward and backward beneath the costal arch in front. While the person takes a deep breath, the kidney, if palpable, may be grasped between the two hands. A kidney that can thus be felt is called a "palpable kidney." A kidney may be "palpable" without being movable. By the term "movable kidney," is meant one which is not only palpable, but which likewise possesses a degree or range of motion in excess of the normal. There are all degrees of mobility in "movable kidney." It may move up and down but slightly in excess of the normal, or it may descend as low as the true pelvis. It may move forward beneath the costal arch as far as the anterior abdominal wall, or it may be moved inward to considerably beyond the middle line. Most English writers divide this subject into "movable" and "floating" kidney, the former being considered an acquired, the latter a congenital condition. The "floating" kidney is described as possessed of a mesonephron of congenital origin which permits of a wide range of motion. As yet no anatomic facts have been presented which demonstrate the congenital origin of a mesonephron, consequently the condition must be considered one of degree only, and the term "movable" kidney will here be used for all degrees of mobility.

Movable kidney is a very common condition, but statistics based upon dead-house reports are very misleading. This unreliability of dead-house statistics is due mainly to two reasons: First, the condition rarely plays any direct part in the cause of death, and consequently is frequently overlooked; and, secondly, when the patient assumes the recumbent position, the kidney usually returns to its normal location, and the post-mortem solidification of the perirenal fat limits its degree of mobility. We therefore turn to clinical experience to determine the frequency of this condition. Küster examined in order 1,733 patients as they applied to him in private practice, and found 44 cases of movable kidney. There were 828 men with 4 cases, or 0.48 per cent, and 905 women with 40 cases, or 4.41 per cent. This is a good illustration of the general average in a surgical practice. In an exclusively gynecological practice, the percentage is much higher, as not far from 20 per cent of such cases will be found to have "movable" kidney (Edebohls).

In considering the *etiology* of movable kidney, two facts stand out so prominently that all etiological factors must be consistent therewith.

These are: First, the proportion of women affected is greatly in excess of men; secondly, the right kidney is affected much more frequently than the left. In 667 cases collected by Kuttner (*Berliner klinische Wochenschrift*, 1890, Nos. 15–17) 584 subjects were women, and 83 men. The explanation of this marked predominance of women over men is found in the body form. The upper or cephalic portion of the abdominal cavity is relatively of much smaller capacity in women than in men. The cavity is not only contracted laterally, but from before backward as well. The effect of this is to displace and distort the organs occupying this zone of the abdomen. The stomach lies in a more longitudinal direction and the pylorus is depressed. The liver is compressed from before backward, thus depressing its anterior and posterior borders. The depression of the posterior border crowds the right kidney lower and tends to displace or tilt the superior pole in an anterior direction. The increased breadth of the female pelvis gives to the psoas muscles a more oblique direction than in the male. This condition produces an obliquity in the sagittal axis of the kidney so that the superior pole lies nearer the middle line than the inferior. The relation between the body form and the location of the kidney is so constant, that by dividing the length of the body from the suprasternal notch to the upper border of the symphysis pubis by the least circumference of the body, an "index" will be found from which it may confidently be predicted in a given case whether the kidney will be found palpable or not. The formula of this index as expressed by Becker and Lennhoff (*Deutsche medicinische Wochenschrift*, 1898, Bd. xxiv, p. 508) is as follows: $\frac{\text{distance jugulo-symphysis}}{\text{least abdominal circumference}} \times 100 = \text{index}$. The greater the index, the smaller the upper zone of the abdomen, and *vice versa*. Therefore the greater the index, the lower the kidney will be found. With an index above 77, the kidney is almost always "palpable," while with an index below 75, it is the exception to find a "palpable" kidney. The body form must, therefore, be considered the predisposing factor in the cause of "movable" kidney, and explains the predominance of movable kidney in women over men.

Etiology.—The chief determining cause is mechanical insult to the kidney. Mechanical influences may be divided into internal and external, the former being the more common and important. By internal mechanical influences are meant all sudden or severe muscular strains, such as heavy lifting, wrenching of the body by slipping or falling, straining at stool, coughing, twisting and turning of the body, in fact any muscular action that produces adduction of the lower movable ribs and thus a constriction of the upper zone of the abdominal cavity. In body forms with high indices, it will be found that the plane corresponding to the least abdominal circumferences cuts the distal portion of the floating ribs in women and passes above the centre of the kidney, particularly the right. The effect, therefore, of adduction of the lower ribs by the internal mechanical influences above mentioned, is to bring

pressure on the upper portion of the kidney and thus depress it. In men, the before-described plane usually passes below the centre of the kidney, so that constriction at this level tends to elevate or compress the kidney.

The truth of the above statements is well exemplified by the statistics of Küster (*Archiv für klinische Chirurgie*). He found that of 295 cases of traumatic subcutaneous rupture of the kidney, 92 per cent were in men and only 8 per cent in women, while of 84 cases of "movable" kidney the percentages were almost reversed—namely, 94 per cent in women and only 6 per cent in men.

By external mechanical influences are meant injuries, such as falls, sudden jolts of the body, or blows about the region of the kidney. That an injury may directly produce a movable kidney, is certain. Harris has seen a movable kidney in a man, produced by his being thrown from a runaway carriage, and a case in a woman, produced by a fall on the buttocks. Cases, however, that are directly and solely attributable to a single injury are not common. Usually, the injury but directs attention, or aggravates somewhat, a kidney already more or less movable.

The principal reason why the right kidney is so much more frequently movable than the left is, unquestionably, the presence on the right side of the liver. This organ forms a firm, resisting body which transmits all force from above directly to the kidney, and prevents it from moving in any direction except downward and forward. The left kidney is not only somewhat more firmly fixed in its location, but has above it only the small spleen and the soft yielding stomach.

What has brought about the body form of the female, which is so favourable to the occurrence of movable kidney? The broader hips, of course, are a sex peculiarity. The narrow contracted waist, however, is an acquired condition produced by artificial constriction which has been operative for innumerable generations. This constriction is due, not alone to the corset, but to the tight skirt bands as well, and the latter are often more harmful than the former, as is shown by the fact that movable kidney is not uncommon in labouring women who have never worn corsets but who constantly constrict their waists with tight skirt bands. According to Thomson (*Edinburgh Medical Journal*, December, 1900), however, Trekaki, of Alexandria, finds that 42 per cent of Arab women, who wear no corset, girdle, or constriction of any kind, have a freely movable kidney.

There are other conditions that are considered by some authors as instrumental in the production of movable kidney. Foremost among these may be mentioned pregnancy. That the influence of pregnancy has been greatly overestimated is apparent when we learn that from 30 to 50 per cent of the cases occur in the unmarried, or in those who have never borne children. In 188 cases seen and collected by Harris, 89 were married, 83 were single, and in 6 the condition was not stated. Of the married, 4 are stated never to have borne children. Comby (*British Medical Journal*, 1898, vol. ii) mentions 18 cases in children.

Two were aged, respectively, one and three months, 6 were between one and ten years, and 10 were over ten years of age. The same argument is applicable against the statement that laceration of the perineum, with prolapse and displacement of the uterus, is a material factor in the causation of movable kidney.

The relaxation of the anterior abdominal wall and diminished intra-abdominal tension following the removal of large abdominal tumours and fluid accumulations, are supposed to favour the occurrence of movable kidney, but in large scrotal herniæ in men and in umbilical herniæ in women, where the intra-abdominal pressure is often very much reduced, movable kidney is not common. Absorption of the perirenal fat, as occurs in wasting diseases, has been emphasized particularly by Landau as an etiological factor. As it is inconsistent with the two fundamental facts stated above, its influence must be considered slight. The course of the ureters through the pelvis is too much of a curve and too much "slack" is present, as shown by the possibility of uretero-ureteral anastomosis, for the kidneys to be materially influenced by displacements of the uterus and tubal disease drawing on the ureters.

The causes of movable kidney, then, may be summarized thus: The principal predisposing cause is the body form. Principal determining cause: repeated internal and external mechanical influences as defined above. Of the minor influences may be mentioned general relaxation of the abdominal walls and kidney attachments following distention, wasting diseases, or enervating conditions.

Fig. 306.—"The kidney descends so low that the hands may be brought together above it."—Harris.

The *pathologic anatomy* of movable kidney varies somewhat according to the degree of mobility. Three degrees of mobility may be described: 1. That in which the major portion of the kidney is palpable; 2. That in which the kidney descends so low that the hands may be brought together above it (Fig. 306); 3. That in which the range of motion is so great that the kidney may descend to the brim of the pelvis, move forward to the anterior abdominal wall, or be moved inward beyond the middle line (Fig. 307). In the first and second degrees, the kidney moves up and down in the connective-tissue space formed anteriorly by the prerenal, and posteriorly by the retro-

renal, fascia. The perirenal fat which varies much in quantity moves mostly with the kidney. As the renal fascia passes between the adrenal and the kidney, the former remains fixed and does not move with the latter. In the third degree, the perirenal fat is often much less in amount and may almost entirely disappear. As the kidney moves anteriorly, it carries with it the prerenal fascia and the peritoneum, so that these structures gradually surround the kidney more and more, forming with the vessels and ureter at the hilum a pedicle or, as it is sometimes called, a mesonephron. The peritoneum is not firmly attached to the kidney as in normal intraperitoneal organs, but loosely fixed thereto, being separated from it by the prerenal fascia and subperitoneal tissue. The renal vessels are often considerably lengthened. Legueu describes vessels that were 11 and 13 centimetres long. The kidney moves through an arc of a circle of which the vessels form the radius and their point of origin the centre. The range of motion is therefore limited by the length of the vessels.

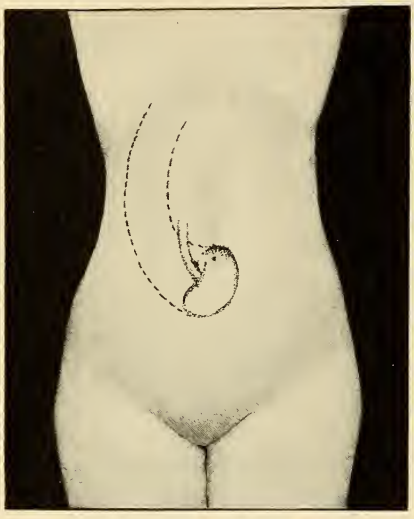

Fig. 307.—"The kidney may descend to the brim of the pelvis."—Harris (page 755).

The large majority of movable kidneys belong to the first and second degrees. Those in which a so-called mesonephron is present are quite rare. At times the kidney, instead of moving up and down in a longitudinal direction, has its superior pole tilted forward, the organ moving in an antero-posterior direction, and approaching the surface just below the edge of the liver between this and the transverse colon (Fig. 308). Again, the kidney may turn about an antero-posterior axis so that the hilum looks upward, and the superior pole may even occupy a lower level than the inferior. More or less of the

Fig. 308.—"At times the kidney . . . has its superior pole tilted forward."—Harris.

upper portion of the ureter usually moves with the kidney, and there is often a marked tendency for the ureter to become sharply flexed or kinked at the junction of the movable with the fixed portion. This kinking of the ureter may interrupt temporarily the flow of urine producing distention of the pelvis and leading, eventually, to the formation of an intermittent nephrydrosis (Fig. 309). The renal vessels may also be sharply flexed so as to interfere with the blood supply to the kidney. A movable kidney may acquire new attachments to neighbouring organs, as, for instance, to the duodenum, the under surface of the liver, the colon, or the small intestine. Such attachments may limit its mobility or prevent its being returned to its normal location. Movable kidney is frequently associated with descent of other abdominal organs such as the stomach, liver, colon, or small intestine. By some authors, it is considered simply a part of a general visceral ptosis which is described under the name of Glénard's disease. Such, however, is not the case, as movable kidney is often found unaccompanied by marked displacement of any other abdominal organ. Dilatation of the stomach has been so frequently found in connection with movable kidney, that a dependent relation is claimed, based upon the fact that the kidney (right) in its movements may compress, drag upon, or so kink the duodenum, as to interfere with the proper emptying of the stomach, or through nervous action disturb stomachic digestion. Frank (*British Medical Journal*, 1895, vol. ii, p. 895) mentions a case of movable kidney so attached to the duodenum that the intestine would be kinked whenever the kidney moved out of place. The characteristic changes of dilatation and chronic catarrh are often found in the stomach. In left-sided movable kidney, the spleen may also be abnormally movable, but it usually retains its proper location.

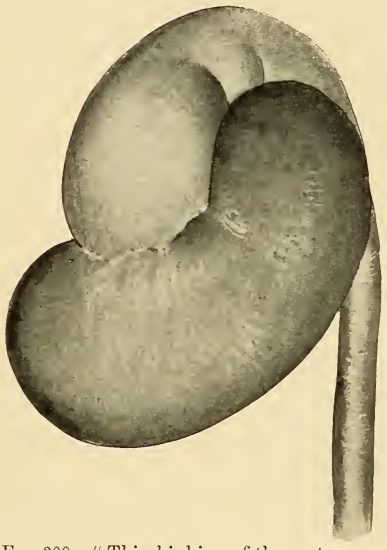

Fig. 309.—"This kinking of the ureter may interrupt temporarily the flow of urine, . . . leading to the formation of an intermittent nephrydrosis."—Harris.

Symptomatology.—In a systematic examination of patients, one frequently finds movable kidneys that have given rise to no symptoms whatever, and whose presence was unknown or unsuspected until discovered incidentally during the examination. On the other hand one sees patients whose lives are made miserable by a train of symptoms produced by a movable kidney. Between these extremes all degrees

will be found. The number and severity of the symptoms do not necessarily depend upon the degree of motion present, as there may be more suffering in one case with motion of the first degree than in another with motion of the third degree. It is, at times, difficult to state why one patient should suffer so much and another so little. In sudden displacement or acute dislocation of the kidney, the result of an injury, there is always pain in the side affected, and the patient often states that a feeling as if something had given way in the side was experienced. The pain may be quite severe, and be attended by nausea or vomiting. There may be a frequent desire to urinate and, at times, a little blood in the urine. That side will be tender to touch, and, on examination, the kidney may be felt in its dislocated position. The kidney may be found dislocated forward along the under surface of the liver, or downward behind the cæcum, or inward toward the middle line. It may return spontaneously to its normal location or appear somewhat fixed, requiring gentle manipulation to reduce it. After reduction, the symptoms quickly subside. After an acute dislocation, the kidney may regain its former fixed condition, or it may remain permanently more or less movable. The symptoms attributable to movable kidney may be arranged under four heads: Pain; disturbances of the urinary organs; disturbances of the gastro-intestinal tract; disturbances of the nervous system. The pain is located in the lumbar region just below the twelfth rib, or anteriorly extending from the costal border down the side toward the inguinal region or the bladder. It may be located over the region of the appendix, and Edebohls has particularly directed attention to the association of appendicitis with movable kidney. The pain may be quite acute, or, more commonly, a dull aching or a dragging feeling which is aggravated by standing, walking, or lifting.

Of the urinary symptoms, frequent urination is the most common. It is most marked when standing, and usually disappears at night or when lying down. The desire to urinate frequently may be periodic. Harris had a case of a woman with a movable right kidney who, at irregular intervals, would have severe attacks of painful, frequent urination, lasting several hours. She was permanently relieved by fixing the kidney.

Gastric symptoms are among the most common with which these patients are affected. They are the usual symptoms noted in gastric dilatation and chronic catarrhal gastritis, such as pain and distress after eating, eructations, nausea, and, at times, vomiting. There is tenderness on pressure in the epigastric region, and the abdominal aorta pulsates so markedly at times that one may be led to suspect an aneurism. Fütterer calls attention to a bruit sometimes heard over the renal artery, which he considers due to a partial kinking of that vessel. Rarely, jaundice has been noted, caused probably by the kidney drawing on the hepatico-duodenal ligament. Constipation is the rule and flatulence common. In connection with the nervous system, we find

dizziness very common, headaches, frontal or occipital, and, at times, all the vague nervous disturbances of hysteria and neurasthenia. Sometimes, the mental state is one of depression or despondency amounting almost to melancholia. Patients with movable kidneys are liable to acute attacks, at irregular intervals, which are quite characteristic. They consist of acute pain in the region of the kidney often extending down the ureter to the bladder, with frequent, scanty urination, and nausea or vomiting. These attacks may be very severe and may simulate renal colic due to calculus. They are called Dietl's crises and are probably due to a sudden twisting of the pedicle, causing a kinking of the renal vessels and ureter and a drawing on the renal nerves. They disappear on returning the kidney to its normal position.

Many of the foregoing symptoms will be found aggravated during menstruation, and the kidney at this time is usually somewhat larger and more tender to pressure. It is not to be expected that all these symptoms will be present in any one case, but the cases may usually be grouped according to the prominence of particular symptoms. We thus find that in some cases the symptoms are referred principally to the urinary organs, in others to the gastro-intestinal tract, and that in yet a third group the nervous symptoms are the most prominent. It should also be remembered that movable kidney is frequently found associated with other conditions, such as lacerations of the pelvic floor, uterine displacements, tubal and ovarian diseases, chronic appendicitis, gastric disturbances due to other causes, visceral ptosis, anæmia, etc., so that, in individual cases, judicious discrimination is often necessary in assigning to each condition its proper influence in determining the symptoms present. Owing to the relations of the right kidney to the duodenum and bile tracts, gastric symptoms are usually more pronounced when the right kidney is involved than when the left alone is movable. The diagnosis of movable kidney must always rest on the findings of a physical examination. (See Physical Examination.)

The *treatment* of movable kidney is palliative and operative. Palliative treatment consists of the use of abdominal supports, pads and trusses, massage and symptomatic treatment. In patients with lax, dependent abdomens, with or without general visceral ptosis, the use of a well-fitting, firm, abdominal supporter is often followed by marked relief. In those cases in which the superior pole of the kidney tilts forward, and the kidney approaches the anterior wall below the edge of the liver, a properly applied pad may materially aid in retaining it in position, but, in the majority of cases, in which the kidney has a downward movement, it is practically impossible to retain it in place by pad or truss, and most observers are agreed that the use of mechanical appliances is here without material benefit. Massage has been recommended particularly by Kumpf with the idea that thereby a retraction of the peritoneum around the kidney may be brought about, thus fixing it again in place. That such result is ever obtained is more than doubtful. However, massage may be of benefit in restoring tone to a

relaxed abdominal wall, in overcoming constipation, and in improving digestion, thus relieving many of the symptoms accompanying this condition.

Symptomatic treatment should deal with the condition of the stomach, the constipation, the anæmia, the nervous symptoms, etc. In this manner, all associated or incidental conditions may be relieved, leaving such as are due directly to the movable kidney. A movable kidney can be permanently restored to its normal location by operation only. Not all cases, however, require operation. Operation is advisable: 1. When distinct symptoms are present which are unrelieved by mechanical or symptomatic treatment; 2. Where secondary changes in the kidney are present, due to the mobility (nephrydrosis, nephritis). In those cases associated with general enteroptosis, an operation on the kidney should be followed by mechanical support of the abdominal wall. Those cases which are relieved by pads or trusses should be given the option of an operation with release from the annoyances of mechanical appliances. The gravity of the operation in uncomplicated cases is slight, the mortality being from 1 to 2 per cent—374 cases with 4 deaths (Albarran). Relief from symptoms is most marked in those cases in which pain, and urinary and gastric disturbances, are most prominent. In such, the results are usually very gratifying. In the distinctly nervous type, much less can be promised, as such patients are frequently confirmed neurasthenics or hysterical, and such states are likely to persist.

However, if it can be shown that the nervous state has its origin in the movable kidney, much good may result from the operation. The operation is that of nephropexy or fixation of the kidney. (See Operation on the Kidney.)

Anomalies of the Ureters.—The most common anomaly of the ureter is duplication. This may occur unilaterally or bilaterally. The second ureter may extend from the kidney to the bladder, opening into this organ usually a little above the normal opening, or the supernumerary ureter may join its fellow at any point along its course. It may terminate at the bladder in a blind tube which, as it becomes distended with urine, may project into the bladder as a cystic pouch. This pouch may even obstruct the opening of the normal ureter and thus give rise to a nephrydrosis. The ureters may open abnormally into the bladder, both ureters opening on the same side. A ureter may open near the internal orifice of the urethra or even into the urethra or the vestibule alongside of the meatus urinarius. In the latter two cases, permanent incontinence of urine will be present, as the urine will escape continuously from the open ureter, and a surgical operation, having for its object the implantation of the ureter into the bladder, will be necessary to correct the condition.

Stricture of the ureter may result from cicatricial contraction following internal trauma due to the passage of a stone; to laceration

from overstretching of the body, and to injury from external violence. The contraction leads to dilatation of the ureter (hydro-ureter) above the seat of the obstruction and to the development of a nephrocystosis (*q. v.*).

The latter condition usually first directs attention to the possibility of a stricture which may then, at times, be located by means of the ureteral bougie. Attempts have been made, and with some success, to dilate ureteral strictures by passing bougies as in urethral strictures. Should this not succeed, an operation may be necessary. The ureter may be reached through an extended oblique incision, the peritoneum being raised up and carried inward. The stricture, if it is a narrow one, may be divided longitudinally and stitched transversely after the manner of the Heineke-Mikulicz operation on the pylorus (Fenger); or the stricture may be resected, the upper end of the lower portion of the ureter ligated, a small slit made in the canal just below the ligature, and the lower end of the upper portion, which has been slit up slightly, invaginated into the lower portion through the slit in the side and retained by fine catgut stitches (Van Hook).

Calculi may lodge in the ureter in their passage from the kidney. The points at which lodgment most frequently takes place are at the contracted portion just below the pelvis, at the point where the ureter curves to dip into the pelvic cavity, and just before it enters the bladder. When a stone lodges, it interferes more or less with the free passage of the urine along the canal, and the usual changes take place above the seat of the obstruction. The stone may ulcerate through the walls of the canal and materially increase in size in the little pocket which it forms. Harris has seen such a stone lying at the brim of the pelvis and measuring over 3 centimetres in diameter. There are no characteristic symptoms of ureteral stone. A history of acute pain or "colic," incident to the passage of the stone from the kidney to its place of lodgment, might be elicited and the fact that, following such an attack, no stone had been passed might suggest the possibility of one remaining lodged in the ureter, particularly if symptoms of renal enlargement appeared soon after. Very rarely, a stone in the abdominal portion of the ureter has been palpated through the abdominal wall. Those lodged in the lower portion of the canal have frequently been felt through the vagina. Usually, the stone is discovered by passing ureteral bougies either from below or above, while endeavouring to discover the cause of obstruction in nephrocystosis. A stone lodged in the upper end of the ureter has been dislodged or pushed back into the kidney by the ureteral bougie. When lodged farther down, its passage into the bladder has been facilitated by injecting sterile oil through a ureteral catheter below the stone (Kolisher. From the lower, or vaginal, portion of the ureter, stones have been removed through an incision from the vagina, and when in the bladder wall, by dilating the ureteral opening through the cystoscope or a suprapubic opening. When situated

in the abdominal portion, it may be removed through the extended oblique incision mentioned under Operations on the Kidney. The ureter should be incised, the stone removed, and the incision stitched with fine catgut. If unable to close the ureter, it may be left open, a packing of gauze in either case being placed down to the opening to guard against leakage.

In case of injury to the ureter, such as accidental puncture or incision during operations within the pelvis, the unilateral wound should be closed at once by fine catgut stitches. If completely divided, an immediate anastomosis should be made after the method of Van Hook (see Strictures of the Ureter), or if near the bladder, the proximal end should be reimplanted in the bladder at the most convenient point. In case neither of these procedures is possible, it may be necessary, as a last resort, to implant the ureter into the bowel and run the risk of an ascending infection of the kidney, or to bring the end to the surface at some point leaving a permanent fistula, or to remove the corresponding kidney. Fortunately, owing to the success of ureteral anastomosis, these latter alternatives will seldom be necessary.

Nephrocystosis.—If the escape of urine from the kidney is interrupted, completely or incompletely, for a sufficient length of time, by any cause acting upon the excretory channels, dilatation of the pelvis and calyces of the kidney results, producing the general condition of nephrocystosis (cystonephrosis). This condition may be subdivided into nephrydrosis (uronephrosis, hydronephrosis) when the fluid contained in the dilated pelvis is urine or modified urine; and nephropyosis (pyonephrosis) when the additional element of infection is present with the formation of pus.

Nephrydrosis may be congenital or acquired. The *congenital* variety may be unilateral or bilateral. When bilateral, the child is not viable, and hence is not a subject for surgical relief; when unilateral, the condition is perfectly compatible with life. The cause of the nephrydrosis is usually some error of development such as double ureter, one or both of which may be imperforate or stenosed, or imperforation of a single ureter. The ureter may open at some abnormal point such as the vestibule, vagina, urethra, uterus or tubes, in which case the orifice is apt to be small and contracted and the ureter dilated above it. The ureter may enter the pelvis of the kidney so obliquely, or in such an abnormal manner, as to lead to a valve formation interrupting the free escape of urine from the pelvis into the ureter. The ureter may be sharply flexed by a malposition of the kidney or compressed from without by an abnormal or anomalous renal artery.

As a result of some of these abnormities the dilatation may be present at birth, thus being strictly congenital. In other conditions, as for instance valve formation at the uretero-pelvic junction, the nephrydrosis may not develop to a perceptible degree until many years

after birth or in adult life. While in these cases the cause of the dilatation is of congenital origin, their late development makes it better to classify them, at least clinically, under the head of *acquired* nephrydrosis. The most common cause of acquired dilatations is pressure on the ureter in its course through the small pelvis. This may be due to carcinoma of the uterus, particularly of the cervix, to intraligamentous fibromyomata or other tumours of the small pelvis, or to the pregnant uterus compressing the ureter at the pelvic brim. (Olshausen, *Sammlung klinische Vorträge*, 1892.)

Displacements or prolapse of the unenlarged uterus seldom produce obstruction of the ureter. Epitheliomata or other tumours of the bladder, if located near the ureteral orifice, may be the cause of obstruction. Internal obstruction of the ureter may be due to the lodgment of a calculus; to cicatricial contraction, the result of an injury inflicted by the passage of a calculus or the uric-acid infarcts of early infancy (Bernard); or to strictures the result of external trauma or of tuberculosis of the ureter.

An interesting and important cause of nephrydrosis is movable kidney (Landau). Harris has seen a typical case of intermittent nephrydrosis of small size, due to a movable kidney kinking sharply the upper end of the ureter, also one due to a "Schnür" lobe of the liver displacing the kidney and kinking the ureter. Both were completely relieved by operative correction of the position of the kidney. Not all cases of intermittent nephrydrosis, however, are due to movable kidneys, as certain valvular formations about the uretero-pelvic orifice and other conditions, not always readily explainable, may permit the irregular or periodic evacuation of the sac. The fundamental factor in all cases of nephrydrosis is an obstruction to the escape of urine from the pelvis of the kidney. This obstruction, as has been shown, may vary much in its nature and location.

The *pathologic changes* begin at the point of obstruction and extend centrad. Thus, if the obstruction is located at the lower ureteral orifice or in the bladder, the entire ureter will be found dilated; if the obstruction is located along the course of the ureter, only that portion lying above or centrad of it will take part in the dilatation; while if the obstruction is at the uretero-pelvic junction the ureter will not be involved. There may be multiple points of obstruction with sacciform dilatations between them. In enlarging, the ureter becomes thickened and elongated and assumes a curved or serpentine course. The upper part is particularly prone to assume an S-shaped curve (Albarran) which may become secondarily kinked or compressed by the enlarging pelvis. The dilatation of the pelvis soon extends to the calyces (Fig. 310). The pyramids gradually become compressed and smaller, and eventually are almost entirely effaced. Occasionally, the calyces, instead of forming a part of the general pelvic enlargement, present fingerlike prolongations. The secreting portion of the kidney becomes flattened and thinned out, resting as a

cap on the enlarged sac. In acute obstructions, the kidney is at first markedly congested, and multiple hemorrhages may take place in the parenchyma or even in the mucosa of the pelvis. As the enlargement continues, the secreting portion of the kidney becomes thinner and thinner, the glomeruli are flattened out, the canals compressed, and their epithelial cells lost. Eventually, this portion of the kidney may be so thinned and spread out in the sac wall as to be no longer detectable macroscopically, although at this stage a little thickening or irregularity on the inner surface of the sac often indicates the location of a former pyramid. The secreting function of the kidney is very rarely entirely destroyed, even when kidney tissue can no longer be detected macroscopically. Ayner found complete destruction of the kidney tissue only 11 times in 473 cases (*Traité de chirurgie clinique et opératoire*, tome viii). The enlargement may vary in size from a slight dilatation of the pelvis to an immense tumour filling the abdominal cavity and containing from 15 to 20 litres of fluid. The sac wall is usually much thickened, but may be quite thin in places. Attachments by adhesions to surrounding organs are common, rendering the complete removal of large sacs at times very difficult or impossible.

Fig. 310.—"The dilatation of the pelvis soon extends to the calyces."—Harris (page 763).

Partial nephrydrosis, a condition wherein but a part of the kidney is involved in the process, may result when the anomaly of double ureter is present with imperforation or obstruction of one (Heller), or when one of the calyces becomes shut off from the pelvis, as has been described by Fenger, Israel, and others, and of which Harris has seen one example. The contents of the sac are always normal or modified urine. In the intermittent variety, the urine may show no changes from the normal, or it may contain blood due to the congestion induced by the retention as mentioned by Albarran (*Annales des maladies des organes génito-urinaires*, 1898, p. 470).

In the closed variety, the fluid gradually becomes more and more changed from normal urine. The specific gravity grows less, the quantity of chlorides, phosphates and urea is diminished, the latter often being present only in traces. The fluid becomes more serous in

character and contains a small amount of albumin with mucous and epithelial cells from the mucosa of the pelvis. Traces of uric acid and oxalates may sometimes be found, even when all urea has disappeared. The fluid is usually more or less clear, but may be coloured by blood from old hemorrhages. Very rarely, the sac may contain a quantity of gas, mostly carbon-dioxide, which may give to the tumour a resonant sound on percussion.

Symptomatology and Diagnosis.—The symptomatology, strictly speaking, of the ordinary closed nephrydrosis is practically *nil.* The first point which directs attention to the condition is usually the accidental discovery of a tumour in the lateral region of the abdomen. The tumour develops so slowly and insidiously that no symptoms, save perhaps a vague sense of uneasiness or fulness about the side, are experienced by the patient. There may be no changes whatever in the quantity or quality of the urine passed, or symptoms of any kind referable to the urinary organs. As the tumour enlarges, symptoms resulting from pressure upon, and displacement of, neighbouring organs may develop. If the growth of the tumour is observed for a time, it will be found to develop from the upper and lateral region of the abdomen in a direction downward and inward. If seen sufficiently early, the tumour is usually somewhat oval in outline, and occasionally in thin subjects with lax abdominal walls the demarcation between the cystic portion and the kidney tissue may be detected by palpation. As it enlarges, it becomes globular in shape and the surface more uniform. The relations of the tumour to the longitudinal colon, ascending or descending, respectively, are of very great diagnostitial value. This portion of the colon will be found displaced forward, forward and inward, or inward. Very rarely, in a nephrydrosis developing in a movable kidney, the longitudinal colon will be found to the outer side of the growth. The dull area of the tumour should be outlined by percussion while the colon is empty. This portion of the intestine should then be distended with air and the relations to the tumour observed. The so-called "renal ballottement" of Guyon is a valuable diagnostitial sign but not pathognomonic of a renal tumour. The fact that the tumour contains fluid, may usually be determined by the sense of touch and by the presence of fluctuation. The use of the aspirating needle, as means of diagnosis, is seldom advisable. When a tumour is present which, owing to its location and relations to surrounding organs, may be referred to the region of the kidney, segregation of the urines (see Methods of Examination) becomes an important factor in the diagnosis. If, by use of the urine segregator or the ureteral catheter, no urine is found to come from the side corresponding to the tumour and the urine from the opposite side represents the entire output, the tumour may, with almost absolute certainty, be referred to the kidney as its point of origin.

In *intermittent nephrydrosis*, symptoms are frequently present which point directly to the kidney as the source of the trouble. Some

of these are such as are commonly present in movable kidney, such as an aching or pain in the lumbar region or lateral portion of the abdomen, nausea, irregular attacks of frequent urination, etc. Harris had a typical case in a woman who, at irregular intervals, had attacks of frequent and painful urination amounting, at times, almost to strangury. These attacks usually lasted two or three hours. During the intervals, there was no difficulty whatever in urinating and the urine was normal. In this case, a very movable kidney kinked the ureter at its upper portion, producing a mild degree of intermittent nephrydrosis. The tumour in these cases does not become so large as in the closed variety, and is often scarcely perceptible. In other cases, a tumour of moderate size has been noticed by the patient, which, at times, suddenly disappears, its disappearance being accompanied by an unusual flow of urine. This rise and fall of the tumour is quite characteristic of an intermittent nephrydrosis. Intermittent hematuria has occasionally been noticed in these cases. The introduction of the ureteral catheter up to the pelvis of the kidney may drain away the fluid and cause the collapse or disappearance of the tumour. The diagnosis of nephrydrosis is never complete without taking into consideration the nature of the condition giving rise to the obstruction. This should always be carefully sought. The course and prognosis of these cases depend entirely upon the nature of the obstructing cause. A simple closed nephrydrosis may exist for years with little inconvenience to the patient, provided the opposite kidney is normal. When both sides are affected, the end in uræmia is seldom long delayed. When due to carcinoma of the bladder or uterus, death follows as a result of the primary trouble unless that admits of successful surgical removal. Intermittent nephrydrosis due to movable kidney, usually admits of relief by permanently restoring the kidney to its normal location and position. The greatest danger in these cases is that they may become infected, thus converting a nephrydrosis into a **nephropyosis** with all the serious accompaniments of a septic kidney. A nephrydrosis sac may be ruptured by trauma and the contents scattered throughout the peritoneal cavity. This is not necessarily serious, provided the contents are sterile, but when septic, a fatal peritonitis usually results.

Treatment.—As nephrydrosis is a secondary condition, dependent upon some obstruction to the escape of the urine, the treatment should naturally be directed to the cause of the obstruction. We may divide the cases into two classes, namely: 1. Those in which the nature of the obstruction is known and remediable; and 2. Those in which the nature of the obstruction is unknown or irremediable.

Under the first class we may mention the removal of a tumour of the bladder or a vesical calculus that is obstructing the ureteral orifice; removal of a uterine or pelvic tumour pressing on the ureter, and dislodgment of a calculus obstructing the ureter by means of the ureteral bougie or catheter; dilatation of a ureteral stricture with

the bougie. The use of the ureteral catheter *à demeure* is recommended by Pawlik and Albarran in some cases of open nephrydrosis due, probably, to valve formation or compression of the upper end of the ureter. The catheter has been retained for several days with permanent relief. Nephropexy may be done for movable kidneys. This operation should not only fix the kidney, but should fix it in such a position by rotating it, if necessary, about its sagittal axis, that the ureter escapes from the most dependent part. In certain valve formations at the uretero-pelvic junction, plastic operations after the method of Küster and Fenger may be tried. Strictures of the ureter may be relieved or ureteral stones removed by open operation. All the above procedures have for their aim the conservation of the kidney and its function, and it will be seen how varied is the treatment of this class of cases.

In the second class of cases, we have to deal with the sac or tumour itself, as the cause of the obstruction is unknown or can not be dealt with directly. We have to consider here, First: Aspiration or puncture; secondly, nephrotomy; thirdly, nephrectomy.

While it can not be denied that the use of the *aspirator* has been followed occasionally by success, still, the relief afforded is usually so temporary, and the danger of infection so great, that it can not be recommended as a curative procedure. Occasionally, however, aspiration may be employed for the temporary relief which it affords where the patient is greatly oppressed by the enlargement, and her condition contraindicates more radical measures; or in the later stages of pregnancy when the emptying of the uterus is expected soon to give relief to the pressure on the ureter. The needle should always be introduced posteriorly, so as not to traverse the peritoneal cavity or endanger the intestine. *Nephrotomy* should always be performed by the lumbar route. It is advisable to make the incision so as to be able to explore the ureter and locate, if possible, the source and nature of the obstruction. If this can not be done, the sac should be opened and drained. This will often be followed by permanent recovery but, in the majority of cases, a fistula remains that continues to discharge urine. Ordinarily, such a fistula is of considerable annoyance to the patient by its constant leakage, but, at times, a tight-fitting tube or rubber catheter may be adapted to the fistula and opened at regular intervals with little inconvenience. Nephrotomy should always be the operation of choice when the state of the opposite kidney is in doubt. However, when the opposite kidney is known to be healthy, and it has been found impossible to restore the normal course of the urine on the diseased side, *nephrectomy* should be performed. This may be done as a primary operation, if the patient's condition warrants it, or secondary to a primary nephrotomy. The adhesions usually present, when the sac is large, make primary nephrectomy often a difficult operation.

CHAPTER XLVIII

THE FEMALE URINARY APPARATUS (Continued)

Renal infections; pathologic changes, symptomatology and diagnosis, treatment —Tuberculosis of the kidney; pathologic changes, symptomatology and diagnosis, treatment — Renal calculi; pathologic changes, symptomatology and diagnosis, course and prognosis, treatment—Tumours of the kidneys; pathology, symptomatology and diagnosis, treatment—Operations on the kidney: Nephropexy; nephrotomy; nephrectomy.

In **renal infections**, as in infections in other tissues of the body, the essential etiologic factor is the presence of pathogenic microbes. The kidneys, in the performance of their excretory function, are frequently called upon to eliminate bacteria from the blood current, and they may be eliminated in the living state with the urine without the kidneys becoming the seat of pathologic changes. In order that the kidneys may become the seat of the inflammatory conditions herein considered, it is necessary that the bacteria should lodge and develop there. There are certain antecedent conditions which favour this lodgment and development of the microbes. Among these may be mentioned: The ingestion of certain medicaments which produce an active hyperæmia with exfoliation of cells of the kidney, such as turpentine, copaiba, cantharides, etc.; the presence of toxines, the result of bacterial invasion elsewhere in the body; congestion of the kidneys due to obstruction to the return circulation or to chilling of the surface of the body; internal trauma, due to the presence of a renal calculus or other foreign body; external trauma, subcutaneous or direct; and, perhaps the most common, obstructions to or interference with the free escape of the urine at some point along the excretory channels. While, at times, the entire organ may appear to be involved, ordinarily the infection is sufficiently limited to warrant the use of certain descriptive terms. Thus we may have a circumscribed parenchymatous infection producing a *kidney abscess*. When the pelvis is more particularly involved, it is termed *pyelitis*. If the infection extends from the pelvis along the collecting tubes to the parenchyma, we have a *nephropyelitis* (pyelonephritis). If, in addition to the infection of the pelvis, we find this cavity dilated, it is called *nephropyosis*. It should be understood that these terms imply simply a difference in degree or extent of involvement, and that the kind of infection and nature of the process may

be the same in all. We may likewise find the different conditions coexisting, as for instance, pyelitis, with multiple parenchymatous abscess, etc. The routes by which bacteria may reach the kidney are four, namely: 1. Through the blood; 2. Along the urinary tract; 3. Through the lymphatics by contiguity; 4. Directly from without by trauma. Infection through the blood is called hematogenous infection; or sometimes descending infection, owing to the direction in which the infection travels. This is perhaps the most common route in the female. The bacteria gain entrance to the blood current from some point of infection elsewhere in the body and are carried to the kidney, where, owing to the presence of some of the antecedent or predisposing conditions above mentioned, they find lodgment and develop. Hematogenous infection may occur in connection with the acute infectious diseases, such as typhoid fever, pneumonia, influenza, etc., or in septic conditions following confinement or miscarriages.

Infection from without inward along the urinary tract is called ascending infection. The first step in the process is usually a cystitis. The changes may remain limited to the bladder for an indefinite time as the ureteral orifices offer a considerable barrier to the passage of any of the contents, bacteria included, of the bladder into the ureters. However, when the bladder becomes distended or contracts vigorously to expel its contents through an obstructed channel, or when inflammatory changes, ulceration, etc., involve directly the ureteral orifices, these may become incompetent and permit infection to ascend into the ureters. It is unnecessary that the ureter throughout its entire length should become involved in the inflammatory process, as it has been demonstrated experimentally that bacteria, as well as minute inanimate particles, may be carried along the ureter to the pelvis of the kidney by antiperistaltic action of the ureter or by propagation along the urinary column.

Even in the presence of a cystitis, it is not always essential that the bacteria should reach the kidney through the ureter, as a hematogenous infection may take place from such a local infection as well as any other. Propagation by contiguity may take place from the bowel in colitis, severe constipation, subcutaneous contusion of the bowel, etc., as, when the integrity of the bowel wall has been compromised in any manner, bacteria may escape through it.

Infection may also occur as the result of a perirenal abscess due to an appendicitis, an infection from the gall bladder, or from a hepatic or subphrenic abscess. Direct infection is always due to a penetrating wound.

A variety of bacteria have been found as the infecting agent in these cases. In 79 cases reported by Albarran, Schmidt and Aschkoff, Wumschein and Savor, the colon bacillus was found pure 48 times, 6 times associated with *Bacillus proteus*, and 5 times with the staphylococcus or streptococcus; with the *Staphylococcus pyogenes aureus* or the streptococcus, 11 times; the *Bacillus typhosus*, twice; and the *Diplococcus*

pneumoniæ, once. Although the gonococcus is unquestionably a common cause of the urethritis and cystitis which so often precede the renal infection, it does not appear to have been frequently found alone in the kidney. From the foregoing, it will be seen that the colon bacillus is the organism most commonly found in these cases, and this fact indicates the frequency with which the infection proceeds from the intestine. In the etiology of nephropyosis, all those conditions which lead to dilatation of the pelvis, mentioned under nephrydrosis, are equally active, the only difference being the addition of an infection.

The *pathologic changes* vary somewhat according to the manner of infection. In hematogenous infections, there may be one or more abscesses of varying size due to the lodgment of septic emboli, and presenting the same characteristics as pyæmic abscesses in other organs of the body. Again, there may be a diffuse involvement of the kidney with masses of microbes found in the glomeruli and about the secreting tubes, which lead to swelling, coagulation necrosis, and exfoliation of the cells with peripheral leucocytic infiltration. When the infection extends from the pelvis, the microbes are found ascending the collecting tubes, often reaching as far as the secreting portion, producing the same destructive effect on the epithelial cells, and leading to increased interstitial connective-tissue formation.

In pyelitis, the mucosa of the pelvis is thickened and reddish or grayish in colour. Circumscribed denudations or superficial ulcerations may, at times, be seen particularly about the tips of the pyramids. The mucous membrane is often covered by a thin layer composed of pus cells, exfoliated epithelia, microbes, mucus, etc., which gives to the membrane a smooth velvety feel to the touch.

In nephropyosis, in addition to the changes in the mucosa already noted, the pelvis is found more or less dilated. The dilatation may be slight, or so great that the kidney tissue is compressed and flattened out so that the entire organ forms but a large pus sac. Usually, the dilatation is but moderate, and the calyces form pouches or pus sacs communicating with the pelvis, the pyramids being so compressed as to present the appearance of trabeculæ extending through the cavity. Concretions are often found in the calyces or pelvis. A calyx may become shut off from the pelvis, thus forming a circumscribed abscess, and independent abscesses in the kidney tissue which do not communicate with the pelvis are common.

When the infection has been an ascending one, the ureter often shows marked changes due to chronic inflammation. Its walls are much thickened, it becomes dilated, elongated, and tortuous, and reduplications of the mucosa lead to the formation of valvelike strictures. Perinephritis with abscess formation is quite common, and, in nephropyosis, adhesions to surrounding parts the rule.

Symptomatology and Diagnosis.—The symptoms may be arranged under three heads: 1. General; 2. Local; 3. Urinary Changes. The onset may be acute or slow and insidious. When renal abscesses

occur in the course of a pyæmia, the condition is usually unrecognised owing to the severity of the general disorder, and the abscesses are found only at the autopsy. In an acute case following general exposure, or after confinement, or from a sudden extension of an infection from the bladder, the temperature will be found elevated, 101° to 103° F., with the usual symptoms accompanying fever. Locally, there will be pain in the lumbar region with distinct tenderness as the kidney is grasped between the two hands. In many cases of ascending infection, the kidney becomes involved so insidiously that it is frequently impossible to tell just when this organ began to be affected. There will be an elevation of a degree or two in the temperature, particularly toward evening, with gradual loss of weight and deterioration of the general health. The kidney, if palpable, will usually be felt to be slightly enlarged and tender on pressure. There may be pain in the region of the kidney, at times simulating mild attacks of renal colic. Frequent urination is the rule, and it may be present even when there is no involvement of the bladder. Changes in the character of the urine are always present. It will be found to contain a variable amount of pus and albumin, numerous bacteria, and epithelial cells from the pelvis as well as from the tubules, should these be involved. Cylindroids and casts will be present if the kidney substance is affected, but may be absent when the infection is limited to the pelvis. The reaction of the urine will depend upon the kind of microbe present. The urine may remain acid throughout when the infection is due to the colon bacillus as well as to some varieties of streptococcus, but the usual *Staphylococcus pyogenes aureus* and the proteus decompose urea, thus rendering the urine alkaline. It then often contains the common triple phosphate crystals. There is nothing characteristic about the pus or the epithelial cells to indicate their origin from the pelvis of the kidney. When the origin of these pathologic products is in doubt, it will be necessary to collect the urines directly from the kidneys by catheterization of the ureters, or by the use of the urine segregator.

In nephropyosis the appearance of pus in the urine may be intermittent. If the affection is unilateral, the opposite kidney in the interval may furnish perfectly normal urine. The kidney is always more or less enlarged in nephropyosis, and, at times, the tumour reaches considerable dimensions. The diagnostic points which indicate the renal origin of the tumour have already been referred to under Methods of Examination.

The course of these infections is variable. Many cases following confinement recover entirely. In other cases, the pus may disappear but the bacteria remain, leaving a condition of simple bacteriuria. If the affection is unilateral, it may persist in a mild way for several years without materially injuring the general health, but the opposite kidney is always liable to become affected, which adds materially to the seriousness of the condition. When abscesses develop in the kidney substance or in the perirenal tissues, death may take place from sepsis, or from

uræmia when a considerable amount of the kidney tissue is destroyed. The prognosis is also somewhat influenced by the kind of infection present, a colon-bacillus infection, for instance, being more favourable than one due to the streptococcus.

In the *treatment*, due consideration should be given to antecedent conditions, as cystitis, pelvic infections, primary perinephric abscesses, intestinal complications, etc. For the renal affection itself, the administration of large quantities of distilled water to induce free flushing of the kidneys is of advantage. At the same time may be given some of the antiseptic agents which are eliminated with the urine, and of these the formalin compounds, such as urotropin and cystogen, appear to be the most useful. Salol, boric acid, and benzoic acid, are also, at times, of value. Direct treatment of the pelvis in pyelitis by irrigation through the ureteral catheter, as practised by Kelly, Casper, and others, has given good results in some cases. The solutions used are boric acid; dilute nitrate of silver 1 to 1,000; and bichloride of mercury 1 to 150,000 gradually increased to 1 to 16,000 (Kelly). They should be used warm and with great care. This treatment does not appear advisable in cases with fever (Casper), as chills with high temperature may follow. Should these means fail to give relief, nephrotomy with drainage through the lumbar region may be tried. At the same time, all complicating conditions should be relieved, if possible, such as removal of calculi, correction of strictures or obstructions of the ureter, fixation of movable kidney, etc. As a last resort, and only when it is positively known that the opposite kidney is normal, may nephrectomy be performed.

Tuberculosis of the Kidney.—In acute miliary tuberculosis the kidneys may be involved in connection with the other organs of the body, but as such cases have no special interest to the surgeon, they will not be further considered here.

Surgical tuberculosis of the kidney may exist as a primary affection, or it may be secondary to tuberculosis of other portions of the urinary tract or of contiguous structures. In the primary variety, it is well understood that an infection atrium must have existed at some previous time through which the tubercle bacillus gained entrance to the body, and, in many of these cases, a latent tuberculous focus is found in the shape of an old tuberculous bronchial or mesenteric lymph gland. The bacilli are carried to the kidneys by the blood and the process is therefore a pure hematogenous infection.

Women are more commonly affected than men in the proportion of 29 women to 14 men (Tuffier); 148 women to 55 men (Albarran); and 73 women to 59 men (Bangs); a total of 378 cases, with 250 women, or 66 per cent. Almost any age may be affected, but 75 per cent of the cases occur between the ages of twenty and forty years. The kidney is primarily affected in a majority of the cases, and usually, at first, but one organ is involved. Later the opposite organ may become affected.

Tuberculosis of the kidney secondary to involvement of the lower urinary tract, is not so common in women as in men, in whom we may have a primary affection of the prostate, seminal vesicles, epididymis, etc. A tuberculous abscess originating in the vertebræ (Pott's disease) or from the bowel, may extend to and involve the kidney secondarily.

Fig. 311.—"Tuberculous abscesses are produced." —Harris.

Pathologic Changes. — The most common form observed is the large tuberculous nodule. Such a nodule is made up of a conglomerate mass of histologic tubercles, forming a grayish or yellowish mass varying from 0.5 centimetre to 2 or 3 centimetres in diameter. Often, there is but a single nodule, when it commonly occupies one or the other pole, but they may be multiple and disseminated throughout the kidney. The nodules undergo the usual changes so characteristic of tuberculous tissue, namely caseation, and softening or liquefaction. In this manner, tuberculous abscesses are produced which may rupture into the pelvis or on the surface of the kidney into the perinephric tissue (Fig. 311). The walls of such abscesses become lined with the usual tuberculous granulations which show occasional giant cells (Fig. 312), and the surrounding kidney tissue shows the ordinary inflammatory changes. In tuberculous pyelitis, small tubercles may be found disseminated more or less thickly in the mucosa. As these soften and break down, small ulcers are formed. A single small tuberculous ulcer on one of the pyramids may give rise to pronounced hematuria, which may persist for a long time without any other symptoms being

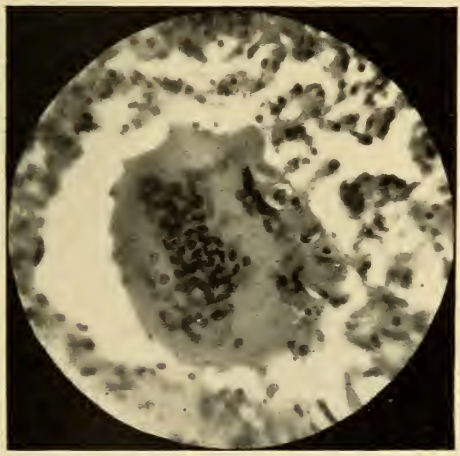

Fig. 312.—"The walls of such abscesses . . . show occasional giant cells."—Harris.

present. The ureter may become involved with the production of caseous nodules or masses, which may interfere with the escape of the urine and thus lead to the development of a tuberculous nephropyosis. A mixed infection in these cases is very common, the ordinary pyogenic organisms being the ones most frequently found. In almost all cases of tuberculosis of the kidney that have existed for any length of time, marked changes occur in the perirenal tissues. Some of the fat becomes absorbed, while the connective tissue is greatly increased in amount. The entire fatty capsule thus becomes converted into a dense, hard mass, surrounding the kidney, and so intimately attached to the adjoining structures, particularly the colon and great vessels, that it is often impossible to detach it from them without great danger of injury. This perinephritis fibrosa may form a tumour of considerable size easily palpable through the abdominal wall. The tuberculous kidney occupies the interior of this dense capsule, and while it is, at times, difficult or impossible to remove the capsule itself, the kidney is fortunately usually easily enucleable from its centre. Provided all the tuberculous tissue is removed with the kidney, this dense perinephric mass may entirely disappear by absorption. When numerous abscesses develop, rupturing into the pelvis or into each other, the entire kidney substance may practically be destroyed, and nothing remain but abscess cavities whose walls are lined with tuberculous granulations. The lymph glands about the hilum of the kidney may become tuberculous, forming distinct separate nodules.

Symptomatology and Diagnosis.—The onset of tuberculosis of the kidney is often obscure. One of the most frequent symptoms in the early stage is hematuria. This may be in quantity scarcely sufficient to give colour to the urine, or quite profuse, and it may persist for some time. It usually appears spontaneously, being discovered by the patient by accident, and is not materially influenced by exercise or repose. If the hemorrhage is profuse enough, clots may form, the passage of which along the ureter may give rise to severe pain. Such clots formed in the ureter have a characteristic wormlike appearance when passed. In the later stages, hematuria is less common. Frequent urination, accompanied with more or less pain, is a very common symptom, and may be present when there is no trouble whatever with the bladder. It is then a reflex or irradiation symptom, and is of great diagnostic value in the early stages. More or less pain or ache in the lumbar region is the rule, and frequently sharp pains of short duration may be felt, which resemble mild renal colic, but which may occur when no solid substance passes the ureter; they are then, probably, in the nature of neuralgia of the ureter. The kidney is usually somewhat enlarged and tender on pressure. Changes in the urine are always sooner or later present, but during the early stage they may not be very marked. Blood, as already mentioned, may be present. It may be so slight in amount as to require the microscope for its detection, or so profuse that the urine may appear like blood. More or less pus is always pres-

ent, together with epithelial cells from the pelvis and tubules. Albumin is found, and in excess of what it is usual to ascribe to the pus present. While casts are not essential to the tuberculous process, a few can usually be found owing to circumscribed patches of nephritis.

The above-mentioned urinary changes are not characteristic of tuberculosis but are common to pyelitis or nephropyelitis whatever the nature of the infecting agent may be. The detection of the tubercle bacillus in the sediment, therefore, is necessary to an absolute diagnosis.

In most cases the bacillus can be found, if sufficient urine is submitted to the centrifuge and the sediment properly stained. It may be necessary to examine a number of specimens before finding any, and sometimes one fails even after repeated examinations. In these cases, inoculation experiments may demonstrate the tuberculous nature of the affection. It is quite probable that a purulent urine, acid in reaction, in which none of the ordinary bacteria are present, comes from a tuberculous kidney, even when no tubercle bacilli can be found. In later stages mixed infection may occur and the urine may be found to contain the ordinary pyogenic microbes as well as the tubercle bacillus. During the early stages, there is usually no fever, but, later, a rise of from one to two degrees is noted toward evening.

The prognosis of tuberculosis of the kidney in general is not good, and when both kidneys are involved it is certainly bad, although recovery is possible. In primary unilateral tuberculosis, where the kidney involved is removed, the prognosis is very good. Harris has patients living five and six years after nephrectomy for unilateral tuberculosis, who are in perfect health. When the bladder becomes affected and mixed infections are present, the prognosis is again bad.

Treatment.—While it can not be denied that tuberculosis of the kidney may be recovered from spontaneously or under treatment, still the probabilities of such a favourable termination are too remote to be depended upon. In primary unilateral tuberculosis, the rational treatment is nephrectomy. Even the presence of beginning trouble in the apex of the lungs or of albuminuria from the opposite kidney is not, in itself, a contraindication to nephrectomy in these cases, as, after removal of the principal and primary focus, these secondary conditions may clear up and disappear. Unless the bladder is actually invaded by the tuberculous process, the vesical symptoms, so common when the kidney is involved, may also entirely disappear after removal of the kidney. It is doubtful if resection of the kidney, as has been done, is advisable in tuberculosis, because even in the nodular variety, it is impossible to tell whether there may not be small impalpable nodules in the apparently healthy portion, or to what extent the pelvis may be involved, thus permitting reinfection.

When the kidney infection is secondary to advanced tuberculosis in other portions of the body or when both kidneys are extensively

involved, nephrectomy should not be done, but, even here, nephrotomy for the purpose of draining large purulent accumulations, may be advisable. In all cases, proper hygienic, climatic, and medicinal measures, should be instituted.

Renal Calculi.—Kidney stones are due to the precipitation and agglutination of salts normally or abnormally present in the urine. These two conditions are absolutely necessary. The substance must not only be precipitated, but the crystals or particles forming it must cohere or become agglutinated to form a mass. Various factors are instrumental in causing precipitates in the urine, such as changes in the reaction and temperature, variations in the relative or absolute proportion of the salts present, and the presence of abnormal constituents. These conditions are brought about by the character and amount of food and drink taken, the nature of the digestive changes, individual peculiarities of internal metabolism, etc.

The fact, however, that uric acid, oxalates, urates, phosphates, etc., may be passed suspended in the urine for almost indefinite periods of time without calculi appearing, shows conclusively that other conditions are essential to stone formation. Among these conditions, may be mentioned a nucleus or centre about which the salts may become deposited. The importance of a nucleus has been mentioned by a number of writers. Ebstein considers that the exfoliated epithelial cells from the tubules or pelvis often form nuclei of stones, but in acute nephritis of scarlatina, where exfoliation is so marked, stones do not occur. Blood clots are likewise often mentioned in this connection, but a blood clot has remained in the kidney a year and a half (Maas) without giving rise to the slightest deposit about it. We must, therefore, search further for a common cause. This has been suggested by Gallippe to be the presence of microbes. Harris, in a recent article on Renal Calculi (*Journal of the American Medical Association*, March 17, 1900), has shown by experimental and clinical evidence the causal relation between the presence of microbes in the urine and stone formation. It has long been known that stones frequently develop secondarily to suppurative infections of the kidneys, and, for this reason, kidney stones have been classed as primary, or those developing in kidneys not the seat of surgical infections, or, in other words, of non-microbic origin; and secondary, or those developing in kidneys the seat of surgical infections, and therefore of microbic origin. Harris has shown, however, that so-called primary stones are likewise of microbic origin.

The facts upon which this statement rests, which are elaborated in the article mentioned, may be briefly stated as follows: Precipitation alone does not cause stone. Foreign bodies, such as exfoliated epithelial cells, blood clots, or those introduced experimentally from without, do not cause stone so long as they remain free from microbes. The kidneys frequently eliminate microbes with the urine without themselves becoming the seat of microbic invasion. These microbes

may develop in the urine in the pelvis and cause the precipitation of certain salts. The character of the precipitate depends, not entirely upon the composition of the urine, but also upon the kind of microbe present. The microbes, in developing, form zooglœa masses, in and about which the precipitate takes place. The agglutination of the particles by the zooglœa mass forms the nucleus or starting point of the stone. Such zooglœa masses have been found clinically in the urine. The microbe most frequently found in the urine is the colon bacillus. It grows in acid urine, and under proper conditions causes the precipitation of uric acid or acid urates. The most common primary stone is composed of uric acid and the urates. Microbes have been found in the centre of so-called primary stones. From the clinical side, we find stones frequently preceded by a history of acute or chronic intestinal disorders; of suppurative lesions of the skin; of acute infectious diseases, as influenza, pneumonia, typhoid fever, etc.; and women very commonly date the beginning of their trouble from a confinement or imperfect puerperium. These conditions are all such as readily account for the presence of microbes in the urine. These facts briefly mentioned lead Harris to state that practically all kidney stones are of microbic origin. The only value, therefore, of the classification of stones into primary and secondary is, that the former may occur in a kidney which is not itself the seat of microbic invasion, while the latter are always secondary to an infective process in the kidney. Of the primary stones, from 75 to 80 per cent are composed of uric acid and the urates. Next in frequency, come oxalate of lime and, rarely, dibasic phosphate of lime. Very rarely, stones have been found composed of cystin, xanthin, indigo, cholesterin and fibrin. The etiology of these is not fully understood. Those of the uric-acid group are yellowish or brown in colour, rather smooth, or even polished if multiple, and often somewhat flattened and oval in shape. Oxalate stones are hard, dark in colour, more or less spherical in shape, and rough or nodular on the surface.

Secondary stones are formed of the decomposition products, such as ammonio-magnesium phosphate, phosphate and carbonate of lime, and urate of ammonium. They are usually whitish in colour, irregular in outline, present a rough granular surface, and are fragile. Stones are frequently not of uniform composition, but made up of different layers. It is very common to find primary stones incrusted with phosphates after the kidney has become septic. Stones may be single or multiple. Harris has removed as many as 52 well-formed bright, polished, uric-acid stones, from a kidney with a history of trouble extending over twenty-five years. In size, they may vary from small granules to a large stone filling the entire pelvis, with irregular branches extending into the calyces and upper end of the ureter, and weighing several ounces. While they usually occupy the pelvis or calyces, stones may be found embedded in the parenchyma of the organ. An important point is the frequency with which stones are found simultaneously in both

kidneys. This has been variously estimated, but about 1 case in 5 or 6 is perhaps near the average. Those of any age may be affected, but from thirty to sixty years is the most favourable time.

Pathologic changes always develop sooner or later in kidneys the seat of stone. These take the form of chronic nephritis, the interstitial changes usually being most marked. The changes may be so extensive that the organ becomes greatly atrophied and its excreting function much reduced. The stone may be so located as to obstruct the free escape of urine from the pelvis, thus giving rise to a nephrydrosis. Even in so-called primary stones, the constant trauma which they inflict upon the interior of the kidney renders the organ particularly liable to infection, and, in fact, this almost always, sooner or later, takes place. There are now added all the additional dangers of a septic kidney: Pyelitis, nephropyelitis, nephropyosis, parenchymatous and perinephric abscesses, etc.

Symptomatology and Diagnosis.—The symptoms may be discussed under three heads: 1. Pain, including tenderness; 2. Changes in the character of the urine; 3. Abnormal urination.

The pain is of two kinds: Acute intermittent paroxysms, which are so familiar under the name of renal colic, and the dull more or less constant ache in the lumbar or lateral abdominal region. The passage of a small stone along the ureter gives rise to an attack of typical renal colic, but similar attacks, perhaps somewhat less severe, may occur without the passage of a stone. The more or less constant pain is usually increased by exercise (driving or riding) that jolts the body, and may radiate in almost any direction, downward to the bladder, upward to the costal region, across the abdomen, or into the thigh. Persistent pain in the latero-lumbar region or radiating in any direction from this region, which is otherwise unaccountable for, should always excite a suspicion of renal calculus. Tenderness over the region of the kidney or along the ureter is often present, and may be of some importance in determining the side affected. One of the most peculiar features of the pain is the fact that rarely it may be located on the side of the body opposite to the kidney affected (Tuckerman, Battle).

Under the head of urinary changes may be mentioned the presence of blood, pus, epithelial cells, crystals, and bacteria, in the urine. The character of the hematuria is of some diagnostic importance. A sudden macroscopic hematuria is probably not due to a stone in the kidney. We more commonly meet with microscopic hematuria. The rather constant presence of a few red blood cells in the urine, discovered only with the microscope, which quantity of blood may be increased by exercise such as dancing, riding, driving, etc., to visible proportions, is quite characteristic of kidney stone. The hemorrhage is due to the local action of the stone on the walls of the cavity which contain it, and is proportionate to the roughness of the surface of the stone and to its degree of mobility. A small movable stone may excite considerable bleeding and a very large fixed one almost none. Pus in the

urine is simply indicative of an infection of some portion of the urinary tract. Its exact point of origin must be known to give it a more specific significance. With the exception of the secreting cells of the kidney, the epithelial cells lining the urinary tract do not present local characteristic differences. The rather frequent or persistent presence of particular crystals in the urine in considerable amount, may give a hint as to the character of the stone present. Bacteria in the urine are of diagnostic importance, aside from determining the kind of infection, only when taken in consideration with other symptoms. It will be seen, therefore, that the urinary changes in themselves are not diagnostic of renal calculus, for the simple reason that it is impossible to tell from their mere presence alone from what part of the urinary tract the pathologic products have had their origin. In order to be certain of their origin, it is often necessary to collect the urines directly from the kidneys, either by catheterizing the ureters, or by the use of the urine segregator. While a stone that gives rise to pain almost always gives rise to pathologic products in the urine, it should not be forgotten that a stone fixed in the parenchyma of the kidney may give rise to pain for years without the appearance of any pathologic elements in the urine (Müller).

Abnormal urination, in the shape of increased frequency or pain, is sometimes present, but is not in itself indicative of stone. At times a stone lodged in the ureter, and rarely one in the pelvis, may be detected by the introduction of a ureteral bougie. Keely has recommended that the tip of the bougie be covered with wax in order that it may receive impressions if brought in contact with a rough stone. The use of the X-ray is often of great value in the diagnosis of kidney stones. A well-defined positive shadow is, under proper conditions, quite certain evidence, but negative evidence can not at present be considered conclusive.

Course and Prognosis.—A stone may exist in the kidney for years without giving rise to serious symptoms, but this is the exception. The chronic nephritis which, to some extent, always follows the presence of a stone, may produce such atrophy as to practically destroy the secreting function of the organ. When infection takes place, the patient is subject to all the dangers and sequelæ of a septic kidney. One of the most dangerous complications which may occur is sudden suppression of the urine or *calculous anuria*. This is due to a stone suddenly blocking up the ureter. It is more likely to occur when both kidneys are affected. In unilateral stone, the suppression in the opposite kidney is due to reflex action but, in these cases, it is probable that the stoneless kidney is always the seat of pathologic changes, such as chronic nephritis, atrophy, cystic degenerations, etc.

In making the diagnosis, it is often difficult to determine on which side the obstruction has taken place. Previous knowledge of the case may be of assistance, otherwise one must depend upon the history of pain and the presence of tenderness. The danger of this complication

will be appreciated when it is stated that the mortality in cases not operated on is about 70 per cent.

Treatment.—The acute paroxysms of renal colic should be treated by the hot bath for its relaxing effect, and the administration of hypodermatic injections of morphine. It may be necessary at times to resort to the inhalation of chloroform. The possibility of dissolving a stone once formed in the kidney is quite remote. The administration of large quantities of distilled water for a considerable period of time is perhaps the most beneficial. The common mineral waters and alkaline springs recommended for this purpose are usually without benefit, and may even cause an increase in the size of the stone by deposits induced by the excessive alkalinity of the urine maintained (Rovsing). Hermann recommended the use of glycerine in doses of 50 to 100 grammes a day, but Senator cautions against its use on account of the hematuria which it may induce. When the kidney is septic, urotropin or cystogen in doses of half a gramme (about 7½ grains) three or four times daily, will be of benefit in so far as they inhibit the growth of the microbes, and thus prevent the decomposition of the urine.

While these means may aid somewhat in washing out gravel or small stones from the kidney, when a stone too large to pass the ureter once forms, relief is only to be expected through surgical intervention. Nor should operation be delayed, for the dangers of a septic kidney are great, and the longer a stone remains, the more pronounced are the changes produced in the kidney. The choice of operation will be between nephrolithotomy, nephrostomy and nephrectomy. In an aseptic kidney, with a so-called primary stone, nephrolithotomy is the proper operation. In the presence of sepsis, with pyelitis, nephropyosis, or abscesses in the parenchyma, in addition to the removal of the stones, drainage will have to be established (nephrostomy). The ureter should always be examined and its patency determined. Should obstruction be found, it should be removed, if possible, and a free communication between the pelvis and ureter established. Should this be neglected or impossible of accomplishment, a permanent urinary fistula is almost certain to follow the operation. Primary nephrectomy for stone is seldom advisable. The opposite kidney must be known to be healthy, and the affected one so destroyed as to be beyond repair, to warrant the operation. It is better to do a primary nephrostomy with a secondary nephrectomy should it be necessary. The combined mortality of the two operations is less than that of primary nephrectomy under the conditions usually presented in bad cases of septic nephrolithiasis.

In anuria from calculus an attempt may be made, under favourable circumstances, to dislodge the stone by means of the ureteral bougie. Should this fail, nephrostomy should be performed. In case no stone is found in the first kidney operated on, the other should be opened at once.

Tumours of the Kidney.—When speaking of tumours of the kidney, we must confine ourselves to true neoplasms, to the exclusion of such

conditions as nephrocystosis, nephropyosis, etc. These, while giving rise to a " kidney tumour " in a purely clinical sense, are, of course, not true new growths in the strict application of the word. What we find in the older medical literature on renal tumours is almost entirely worthless, since, in these reports, every swelling is spoken of under the head of kidney tumour, and even the true neoplasms, in the absence of a proper microscopic examination, were generally classified very inaccurately. Consequently, clinical indications were drawn without proper basis and practical conclusions were utterly unreliable. Only the last few years have brought some system into the unsatisfactory chaos. In certain respects, the permanent kidney is a very peculiar organ. It is preceded in embryonic development by two temporary organs, the pronephros and the " urniere," or Wolffian body. These structures and attached portions of the suprarenal capsule give rise to embryonic remnants which may become included in the permanent kidney and furnish a fertile matrix for subsequent neoplastic formations.

Pathology.—All kinds of tumours may develop in the kidney. Beside the ordinary types of connective tissue and epithelial neoplasms, benign as well as malignant, we find in the kidney two peculiar kinds of tumours which are of particular pathological interest, the hypernephroma and the mixed renal tumours.

Neoplasms of the kidney, according to some authors, occur more frequently in the male than in the female. This, however, is denied by Kelynack (*Renal Growth*, Edinburgh and London, 1898), whose collection of 142 cases shows 70 tumours in males and 72 cases in females. Birch-Hirschfeld affirms that in children renal neoplasms are more frequently found in the female than in the male sex. Renal tumours are found at all ages. The greatest number occur before the tenth year of life. Of White and Martin's 459 tabulated cases, 157 were observed in infants and children up to two years of age. In size, these tumours vary from small nodules to growths of from 30 to 40 pounds in weight. In shape, renal tumours often preserve the outlines of the kidney, even when large. At other times, the kidney shape is entirely lost and the mass becomes irregular and nodular. Of the benign connective-tissue tumours, the fibroma is generally small, hard and round, or elliptical. Occasionally larger fibromata have been observed. The small fibromata frequently found on post-mortem examination are most probably not true neoplasms, but the remnants of focal interstitial inflammatory processes. Lipomata of the kidney are rare, but a small number of cases has been reported. Angeiomata have been sometimes found, but most cases formerly described as such were very vascular sarcomata.

Sarcoma is probably the most frequent of all kidney tumours. It is found in fœtal life, in infancy and childhood, and in adolescence. The importance and frequency of sarcoma of the kidney in childhood has been pointed out by Jacobi in a number of articles. Herzog believes that renal sarcoma is more frequently found in female than in male children. Renal sarcoma occurs as a capsular, a parenchymatous,

and a hilum growth. It may also primarily arise in the suprarenal capsule, to grow secondarily into the kidney. Histologically, we find round and spindle-celled growths, or the cells are of mixed type and character. The sarcoma depicted in Fig. 313, removed by operation from a child nine months old by Harris, and studied as to its histology by Herzog, was of such a mixed type and showed very heterologous connective-tissue elements. The proliferation of tumour cells is well shown in a section (Fig. 314) prepared by Herzog. It was formerly believed that adenomata were among the most frequent, if not the most frequent, of renal tumours. But most of the cases formerly reported as adenomata did not belong to this class of neoplasms, but to the hypernephromata (see *postea*.) True nonmalignant adenomata occur as nodules varying in size from that of a millet seed to that of a hazelnut. They are sharply defined from the surrounding normal tissue. Histologically, they show either an alveolar or a tubular type. It is sometimes difficult to distinguish between a benign adenoma and an early adenocarcinoma, and the more so since some renal adenomata primarily benign, undergo secondary malignant degeneration.

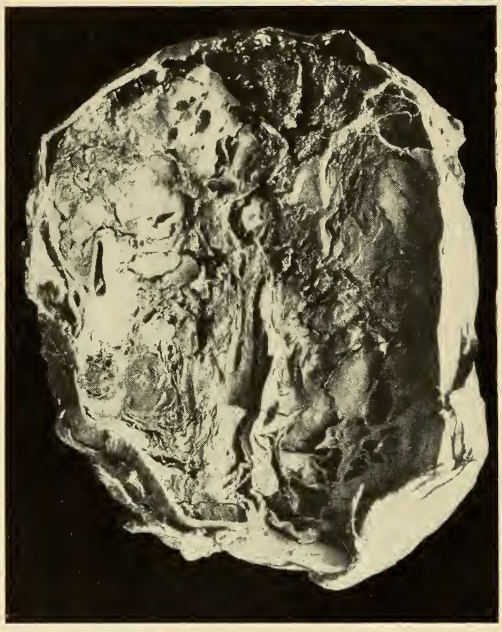

Fig. 313.—"The sarcoma removed by operation from a child nine months old by Harris."—Herzog.

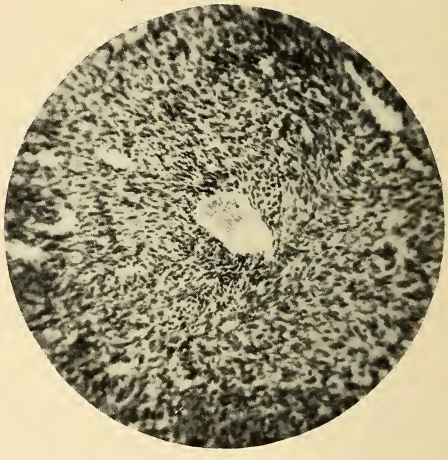

Fig. 314.—"The proliferation of tumour cells is well shown in a section."—Herzog.

Kelynack describes as such forms the malignant papilliferous cystadenoma of the kidney. Epithelial neoplasms which, from the very

start, are malignant in character, in other words typical carcinomata, are not common in the kidney. They may be either soft or hard, and often lead to considerable enlargement of the kidney affected. An embryonal renal adenosarcoma, mixed tumour, 59 centimetres in circumference, was removed by Dr. Denslow Lewis from a child sixteen months old (Fig. 315).

Fig. 315.—"An embryonal renal adenosarcoma . . . removed by Dr. Denslow Lewis."—Herzog.

The histogenesis of *mixed tumours of the kidney, or embryonal renal adenosarcomata,* was cleared up a few years ago by Birch-Hirschfeld, and Herzog was the first to take up this subject in the English language. (Herzog: The Peculiar Mixed Tumours of the Kidney, *Chicago Medical Recorder,* 1899; Herzog and Lewis: Embryonal Renal Adenosarcoma, *American Journal of the Medical Sciences,* June, 1900.) These mixed renal tumours occur very early in life, frequently during the first years, though a very few cases have been reported in adults. They grow very rapidly, speedily lead to general malignant cachexia, and destroy the life of the patient either with or without the formation of metastases. They generally first attract attention by the increasing size of the abdomen. These tumours always develop inside the kidney. The kidney tissue proper, however, does not take part in the proliferating neoplastic processes but becomes compressed by the new growth and the uriniferous tubules, and their lining epithelia disappear in consequence of pressure atrophy. What is left of the kidney sometimes sits on the tumour like a flat cap. These malignant renal tumours are so heterologous in their histology that they have been described as carcinomata, sarcomata, endotheliomata, rhabdomyomata, and under a variety of compound names. The feature common to them all is the fact that they present a mixture of epithelial, adenomatous, and connective-tissue elements, all of which are proliferating in a most extensive embryonal manner (Fig. 316).

These tumours very frequently contain striated muscle fibres which sometimes are so numerous that such new growths were formerly described as rhabdomyomata or rhabdomyosarcomata. Fig. 317 is from a section of mixed tumour, the rhabdomyomatous part showing embryonal

striated muscle cells. They do not tend to form early metastases, but, on the contrary, lead to the latter only after the growth has become so very large that it has broken by pressure through the capsule. The neighbouring lymphatics are not affected even when the epithelial type predominates. Several theories have been advanced as to the origin and the histogenesis of these mixed tumours. Herzog (*loc. cit.*) has advanced the following theory:

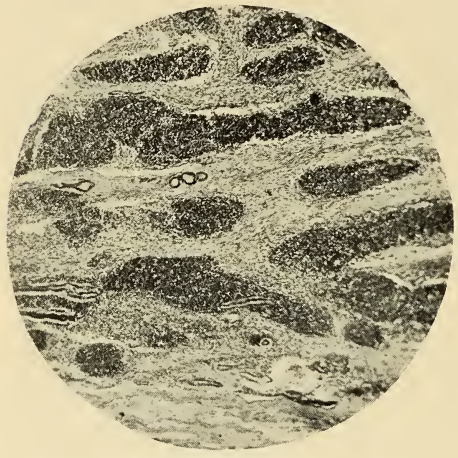

Fig. 316.—"They present a mixture of epithelial, adenomatous, and connective-tissue elements."—Harris (page 783).

"The nephrotome in early embryonic development is not cut off at the normal site, but in such a manner that a part of the myotome is severed from the main mass and remains in conection with the nephrotome. The separation may take place so that only a part of the myotome proper is cut off, or a part of the sclerotome may likewise be taken along. If the former is the case, we have the matrix for striated muscle fibres only; if the latter occurs, we have also the matrix for cartilage. If, now, we assume that a part of the nephrotome (Wolffian body) to which tissues of the myotome have become adherent by an abnormal process of embryonic separation, becomes included in the permanent kidney, we have a matrix containing all those embryonic elements which occur in the mixed renal tumours, namely, striated muscle fibres, cartilage, other connective-tissue elements, and epithelial glandular structures. The latter, of course, are derived from the excretory tubules of the nephrotome."

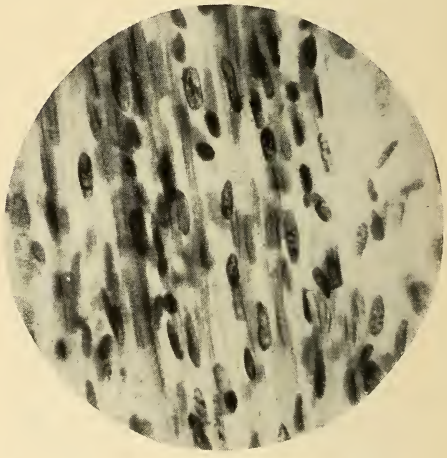

Fig. 317.—". . . A section of mixed tumour, the rhabdomyomatous part showing embryonal striated muscle cells."—Herzog (page 783).

Hypernephromata.—Certain renal tumours described formerly as lipomata or adenomata are now known to be derived from supra-

renal tissue misplaced within the kidney during embryonic development. These tumours were called by Grawitz, who first recognised their true nature, Struma suprarenalis lipomatodes aberrans. They are now generally known under the name of hypernephromata (Fig. 318).

The included aberrant suprarenal tissue may develop into non-malignant tumours. Even the latter are generally slow in their growth, but they usually give rise to metastases. These new growths generally give rise to a dull pain, and frequently produce periodical intermittent hematuria in consequence of their great vascularity.

Fig. 318.—"Hypernephromata."—Herzog.

Histologically, they show a tissue which is an atypical imitation of the structure of the suprarenal capsule. The tumour cells are particularly often found in an arrangement very much similar to that seen in the zona fasciculata of the adrenal gland (Fig. 319). The cells show a universal marked tendency to undergo fatty degeneration, and glycogen is likewise often found (Fig. 320).

Symptomatology and Diagnosis. — The symptoms of renal neoplasms are very meagre, so much so, that it is usually impossible to make a diagnosis as to the particular kind of tumour present. Nearly 50 per cent of the new growths occur in children under five years of age. The appearance of an enlargement in the region of the kidney is, in the majority of cases, the first intimation of trouble. A rapidly growing tumour of the kidney in a child is a sarcoma or a so-called "mixed" tumour. They seldom give rise to urinary symptoms although, in a few cases, some hematuria has been noted. Pain is uncommon but the tumour may be tender. The child may play about with little discomfort until within a few weeks of its death. The tumour often becomes of large size causing great distention of the abdomen. It may be so smooth and soft as to simulate very closely a fluctuating mass. When very large, symptoms due to pressure or distention may be observed. Rapid emaciation and anæmia are marked,

and death takes place by exhaustion in from six to eight months or a year; it is rarely delayed until two years.

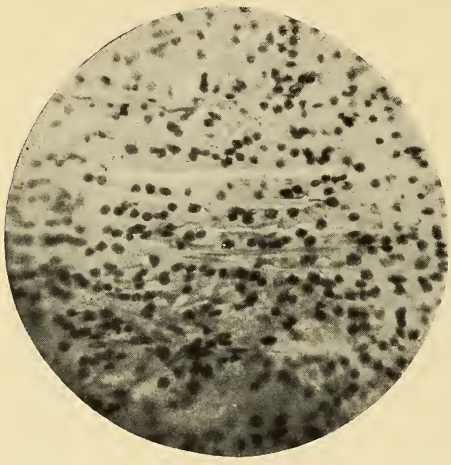

Fig. 319.—"The tumour cells are . . . found in an arrangement very much similar to that seen in the zona fasciculata of the adrenal gland." —Herzog (page 785).

In the adult, hematuria is a much more frequent symptom of tumour than in the child, as it is present in malignant tumours in from 70 to 80 per cent of the cases (Guyon). It is spontaneous in character, appears at irregular intervals, is painless, and is usually discovered by accident. In the majority of the cases, a tumour is already present when the hematuria is first observed, but hematuria may exist for some time before any enlargement can be felt. Pain can not be said to be a characteristic symptom of renal tumours, but a vague, dull ache in the lumbar region has been frequently observed. Carcinoma of the pelvis shows a great tendency to extend to the ureter. This causes an obstruction to the free escape of the urine and leads to the development of a nephrydrosis or nephrohematosis. The duration of malignant tumours in the adult is much longer, on the average, than in the child, as it is usually from two to three or even five years before death occurs. In tumours of the adrenals, hypernephroma, and carcinoma, hematuria is rare. The kidney may often be distinctly felt displaced downward by the tumour enlarging from above. In tumours that destroy the adrenals, such as the carcinomata, marked loss of strength, physical depression, and languor, are quite characteristic symptoms (Ramsay). Some bronzing of the skin has been observed a few times but does not appear to be the rule. There are no char-

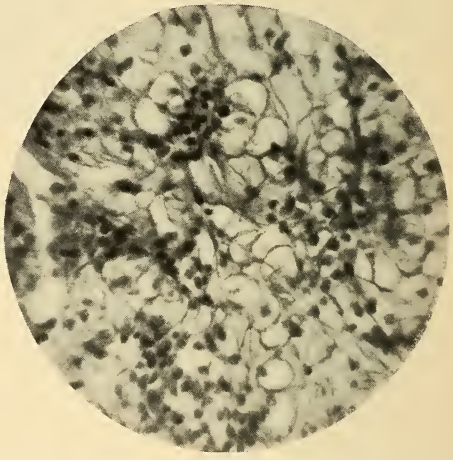

Fig. 320.—"The cells show a universal tendency to undergo fatty degeneration."—Herzog (page 785).

acteristic symptoms by which the rather rare benign tumours can be distinguished.

The *treatment* of tumours of the kidney is removal by nephrectomy. Unfortunately, the onset of the malignant tumours is so insidious that considerable progress has usually already been made when a diagnosis is established. The remote results in the sarcomata of early childhood are not very encouraging, as very few cases indeed are on record which have survived the operation for three years. Owing to the slower course of these growths in the adult, the remote results are better. Wagner has collected 24 cases surviving the operation for more than two years. The immediate mortality of nephrectomy for carcinoma is 24 per cent (Heresco). Partial nephrectomy has been performed a few times for supposed benign growths, usually with recurrence. As it is so difficult to determine whether a tumour is benign or malignant, the advisability of partial nephrectomy is questionable.

Operations on the Kidney.—There are three principal operations performed on the kidney, namely: 1. Nephropexy (nephrorrhaphy) or fixation of a movable kidney. 2. Nephrotomy, the cutting into a kidney, including pyelotomy, the cutting into the pelvis of the kidney for exploratory purposes, for the removal of stone (nephrolithotomy) or for the establishment of drainage (nephrostomy). 3. Nephrectomy, partial (resection), and complete. There are two routes by which the kidney may be reached—the anterior, or transperitoneal; and the posterior, or lumbar. The advantages claimed for the transperitoneal route are: That it permits palpation of the opposite kidney and affords easier access to the pedicle in nephrectomy for large tumours. These advantages, however, have been overestimated. Palpation of the kidney gives little knowledge beyond the mere fact of its existence, which fact can now be learned by other means; and the pedicle can usually be just as easily reached from behind as from the front. On the other hand, the danger of infection, the difficulty of closing the peritoneum posteriorly, and the necessity of providing lumbar drainage, have led surgeons to abandon the transperitoneal route except perhaps in rare cases of misplaced or displaced and abnormally fixed kidneys. A number of incisions have been proposed for reaching the kidney through the lumbar region, as the longitudinal, oblique, rectangular, and transverse. The distance from the twelfth rib to the crest of the ilium is so short that the longitudinal incision seldom affords sufficient working space. The rectangular, or König's incision, starting from the tip of the twelfth rib and extending obliquely downward toward the anterior superior spine of the ilium, then suddenly curving forward and upward, and the transverse incision just below the twelfth rib, are chiefly employed for the removal of large tumours; while the oblique incision, extending from just below and posterior to the tip of the twelfth rib, downward and forward, is the one usually employed in nephropexy, nephrotomy, etc. If the oblique incision is started a little in front of the tip of the twelfth rib, and is extended downward in

the direction of the fibres of the external oblique, it can be made a muscle-splitting incision, the fibres of the external oblique being separated longitudinally, and those of the internal oblique transversely, to the cutaneous incision. The kidney can, in this manner, be reached without dividing muscular fibres, thus minimizing the danger of ventral hernia. The muscle-splitting incision will be found preferable in the majority of operations on the kidney.

Nephropexy or Nephrorrhaphy.—The kidney having been exposed by the muscle-splitting incision, all the perirenal fat should be carefully removed. In doing this the prerenal fascia should be preserved. Two flaps of the transversalis fascia, about 5 to 6 centimetres in length, are now turned back from 2 to 3 centimetres, one on either side of the incision. The anterior flap should be stitched with catgut to the prerenal fascia and to the anterior surface of the kidney, and the posterior flap in a similar manner to the posterior surface of the kidney. We thus have the kidney firmly fixed to the posterior abdominal wall by two flaps of fascia. The flaps should be made as high up as possible, and fixed to the kidney in such a manner that the pelvis and ureter shall have a proper direction and the upper portion of the latter be free from kink or twist that might offer obstruction to the free escape of the urine. That portion of the kidney between the attached flaps will lie in contact with denuded muscle when the wound is closed. The capsula fibrosa may be scarified to excite a freer proliferation of connective tissue. If thought desirable, the kidney may be transfixed by two or more catgut sutures to hold it more firmly in contact with the denuded muscle, or it may be denuded of its fibrous capsule. The wound is then closed and the patient kept in the recumbent position for three or four weeks, to allow sufficient time for firm adhesion to take place. It has been recommended by some simply to expose the kidney freely, draw it up and pack the wound with gauze until granulations are well established, then allow the wound to close. Preference, however, must be given to a closed wound with primary union. The numerous attempts to fix the kidney to the ribs by a variety of sutures have little to commend them. The success of the operation, so far as curing the symptoms is concerned, depends, not so much upon fixing the kidney as high up as possible, as upon fixing it in such a position that its pedicle shall be free and the urine have easy and unobstructed escape.

Nephrotomy.—Expose the kidney by the muscle-splitting incision. If the operation is one of exploration or for the removal of stone, free the organ so that it can be palpated throughout, pelvis included. It should be opened along its posterior border. The incision, which may be made with an ordinary scalpel, should extend into the pelvis and may be as long as deemed necessary. As hemorrhage is likely to be profuse, the kidney should never be incised unless under perfect control of the operator. The organ should be grasped in the hand and the incision made between the thumb and fingers. In this manner, pres-

sure, which readily controls the hemorrhage, is easily applied, and is much to be preferred to clamping the pedicle with forceps. The interior of the pelvis may now be explored, and calculi, if present, removed. It should then be freely irrigated with hot normal salt solution to check oozing and free it of blood clots or *débris* which might form nuclei for new stone formations. If not septic, the kidney should be closed by deep and superficial catgut sutures and the external wound closed as usual. When the object of the nephrotomy is drainage of a suppurating organ, the abscess cavity is opened, cleansed by irrigation, a good-sized rubber drainage tube inserted, and the wound packed with gauze.

Nephrectomy.—The oblique muscle-splitting incision is suitable for kidneys of moderate size. In very large tumours, König's, or the transverse incision, which is particularly applicable in children, will give more room. In malignant tumours, it is advisable to remove as much as possible of the fatty capsule with the kidney. In nonmalignant cases, the kidney is loosened from its surrounding tissue until the pedicle is reached, when, if accessible, the vessels and ureter should be separately ligated with catgut. Should the presence of the kidney interfere with the ligation of the pedicle, an angular clamp may be placed on the vessels and the kidney removed. Should it still be found impossible to ligate the vessels satisfactorily, the clamp may be left in position for about twenty-four hours, when it may be removed with safety. In septic cases, the upper end of the ureter should be fixed into the lower angle of the wound. When there is considerable perinephritis fibrosa, as is common in tuberculosis and other chronic septic conditions, it may be very difficult, or even impossible, to separate the mass from the surrounding organs without great danger of injury, particularly to the colon and vena cava. Harris has seen the colon so injured in this manner as to lead to the formation of a fæcal fistula. In attempting to separate the inner layer of the mesocolon, there is also danger of clamping or ligating one of the colic arteries, which may produce sloughing of a portion of the colon. In these cases of perinephritis fibrosa, it is better to cut directly through to the kidney tissue itself, and to enucleate the kidney from its fibrous capsule. The pedicle may be so involved in the fibrous mass as to render ligation impossible. It will, therefore, be necessary to apply a clamp and allow it to remain for twenty-four hours. The wound should be packed with gauze and the clamp protected by the dressings. If tuberculous deposits are found in the ureter, this canal should be dissected out as far down as possible or until all the diseased tissue has been removed. In all operations on the kidney, and particularly after nephrectomy, the danger of deficient elimination by the opposite kidney should always be borne in mind. It is necessary, therefore, to supply these patients with an abundance of fluid, either by filling the colon with normal salt solution or by injecting it subcutaneously.

CHAPTER XLIX

THE FEMALE URINARY APPARATUS (Continued)

Cystitis: Etiology, bacteriology, pathologic changes, symptomatology and diagnosis, treatment — Hyperæmia, treatment — Foreign bodies in the bladder, treatment — Tumors of the bladder: Symptomatology and diagnosis, treatment—Urethral caruncle, treatment—Carcinoma of the urethra, treatment—Sarcoma of the urethra—Diverticula of the urethra, treatment—Strictures of the urethra — Prolapse of the urethra, treatment — Foreign bodies in the urethra—Dilatation of the urethra, treatment—The urachus—Vesico-umbilical fistula, treatment—Cysts of the urachus.

Cystitis is an inflammatory condition due to the invasion of the walls of the bladder by pathogenic microbes. The urine frequently contains microbes but this is not in itself sufficient to produce a cystitis. It is absolutely necessary that the microbes should lodge and develop either upon or within the walls of this organ, before an inflammatory condition can be established. The *etiology*, therefore, of cystitis may be considered under two heads: 1. Those influences that predispose to the lodgment and development of the microbes; and 2. The manner in which the microbes gain entrance to the bladder. One of the most frequent predisposing causes of infection is congestion. This greatly reduces the resisting power of the bladder and may be induced in a variety of ways. Common among these may be mentioned exposure to cold; overdistention of the bladder from prolonged retention of the urine; obstruction to the free escape of the urine due to stricture of the urethra; intravesical or urethral tumours; displacement of the bladder from extra-vesical tumours, uterine displacements, cystocele, etc.; traumata, such as contusion of the bladder or prolonged pressure from the child's head during labour; contusion from external violence or accidental or unavoidable injury by the surgeon during operations on neighbouring parts; internal trauma produced by foreign bodies, either developed within (vesical calculi), or introduced by the patient from without (hairpins, pieces of pencils, chewing gum, etc.), or by the physician or nurse (catheter, sound, cystoscope, etc.); abnormal states of the urine due to the elimination of irritating substances introduced from without (cantharides, turpentine, oil of sabine, etc.), or developed within the body (toxines from intestinal disturbances, acute infectious diseases, etc.). The bladder participates somewhat in the general congestion of the pelvic organs accompanying menstruation,

and this congestion may be greatly increased by sudden suppression of this function.

The second essential factor in the production of the inflammation, namely, the pathogenic microbes, may gain entrance to the bladder: 1. Through the urethra; 2. From the kidneys with the urine; 3. From contiguous parts; 4. From the blood. The most common route is undoubtedly along the urethra. The shortness of this canal in women makes it much easier for microbes to enter the bladder through it in them than in men. Gonorrhœal infection, which always affects the urethra, may extend to the bladder. Infections from other microbes involving the vulva, vestibule, or vulvo-vaginal glands, may likewise extend along the urethra. The germs may be carried to the bladder on septic catheters or other instruments. Even a sterilized catheter may carry germs that are within or about the meatus into the bladder. The bruised and congested condition of the bladder following confinement or operations on the generative organs, makes the introduction of germs by the catheter particularly liable to excite a cystitis. The greatest care should, therefore, always be taken in cleansing the meatus and adjoining parts, and in sterilizing and introducing the catheter under these conditions. The patient herself may introduce the germs on all sorts of foreign bodies used for masturbating purposes or when mentally deranged. Germs frequently reach the bladder by descending with the urine from the kidneys. It is not necessary that the kidneys be diseased, as it is well known that these organs frequently eliminate microbes from the blood without themselves being involved thereby. This may take place in the acute infectious diseases, in diseases of the intestinal tract, and in suppurative conditions in other portions of the body. The kidneys, however, may be the primary point of infection, as in pyelitis, nephropyelitis, etc., and this is particularly common in tuberculous infection. The transmission of microbes to the bladder by contiguity may occur in intrapelvic suppurative conditions such as pyosalpinx, circumscribed suppurative peritonitis, infections of the uterus, etc. Such purulent collections may rupture into the bladder, thus carrying infection directly. Infection may come from the rectum, from a loop of inflamed bowel that has become adherent to the bladder, or even from the appendix, as Harris has seen in one case. The introduction of germs by direct trauma, as in bullet wounds, punctured wounds, etc., is possible but not common. Lastly may be mentioned pure hematogenous infections, where germs reach the bladder wall through the blood, as either minute septic emboli or floating germs. The normal bladder possesses considerable immunity to infection. Therefore, in addition to the germs, which are the essential element of inflammation, certain of the above-mentioned predisposing conditions must be present to temporarily reduce the resisting power of the tissues in order that the germs may lodge and develop and cystitis be produced.

Bacteriology.—To the investigations of Bumm, Clado, Halle and Albarran, Krogius, Escherich, Posner, Lewin, Melchoir, Rovsing and

others, is due our knowledge of the bacteriology of cystitis. Many varieties of bacteria have been found in the bladder. The one most frequently present is the colon bacillus. It reaches the bladder, usually, from the kidneys with the urine, but may pass directly from the bowel to the bladder when these two organs are connected by inflammatory exudate or adhesions. It may also enter through the urethra. This is most common in very young girls, where, in the presence of acute intestinal disturbances, from lack of cleanliness, a vulvar inflammation develops and the infection extends along the urethra to the bladder. As the colon bacillus does not decompose urea, the urine remains acid in colon cystitis. The gonococcus almost always enters the bladder through the urethra. This may occur during an acute gonorrhœa or during one of the frequent slight exacerbations of a chronic or latent infection. Many of the cases of cystitis following childbirth originate in the latter manner, favoured by the bruised condition of the bladder and urethra incident to the labour. The gonococcus, likewise, does not decompose urea. Of the ordinary pyogenic microbes, the streptococci are more frequently found than the staphylococci. They may reach the bladder on unsterilized instruments or from contiguous suppurating foci, and are frequently found associated with tumours of the bladder, as the epitheliomata, papillomata, etc. The streptococci do not decompose urea but almost all the staphylococci do. Therefore, in the presence of the latter, we find ammoniacal alkaline urine. The proteus of Hauser has been found a number of times in cystitis. It acts very energetically on urea and the urine is therefore strongly ammoniacal. The prognosis in infection by the proteus of Hauser is unfavourable, as 3 out of 4 subjects seen by Melchoir died. Krogius saw 2 subjects, both of whom died. The tubercle bacillus is a common cause of chronic cystitis and usually infects the bladder from a tuberculous focus in the kidney. The urine in tuberculous cystitis remains acid. Other bacteria have occasionally been found in cystitis, but not with sufficient frequency to demand special mention. Mixed infections may likewise occur.

The *pathologic changes* produced are much the same regardless of the particular kind of microbe present, with the exception of the tubercle bacillus which alone produces somewhat characteristic changes. Marked differences, however, exist in degree. The same variety of microbe may at one time produce the most extensive changes, and at another time almost none, for reasons that can not better be expressed than by the terms, "varying virulence" on the part of the microbes, and "power of resistance" on the part of the bladder. The changes produced are hyperæmia with swelling and infiltration. These may be circumscribed or diffuse. In the former case, they may be limited to a small area about the inner orifice of the urethra, to the trigone, or to a small area about one or the other ureteral orifice. In severe cases, the mucosa is considerably swollen and thrown into folds. It is soft, often œdematous, and small hemorrhages are not infrequent. Erosions

may occur, particularly on the folds. Papillomatous elevations which are soft and bleed easily on touch may form. Inflamed areas may become covered by a grayish or yellowish membranelike substance composed of pus cells, mucus, bacteria, detached epithelial cells, etc., in which phosphates may be deposited, and which may adhere quite intimately to the mucosa. The changes may extend to the submucosa and muscularis, where abscesses may form that may rupture into the bladder or into the pericystic tissues. The inflammatory changes may extend through the entire wall of the bladder producing a pericystitis. In chronic cases the muscularis becomes greatly hypertrophied, the walls much thickened, and the capacity of the organ markedly reduced. In a particularly virulent infection following childbirth or some of the acute infectious diseases, the mucosa may slough. A diphtheritic cystitis may likewise occur. In tuberculous cystitis the changes are usually circumscribed and appear first about the ureteral orifices. Small, slightly elevated tubercles, may be seen, which undergo caseation and softening, and break down forming small ulcers. There may be but a single ulcer or they may be multiple. When a mixed infection is present, the usual changes may be seen in addition to the ulcers.

Symptomatology and Diagnosis.—Cystitis manifests itself by painful, frequent urination, and changes in the character of the urine. The severity of the symptoms varies greatly. In acute cystitis, the desire to urinate is very urgent and the pain accompanying the act quite marked. The increased sensitiveness of the mucosa impels the patient to evacuate the bladder so soon as a small amount of urine accumulates within it, and the contraction of the muscle incident thereto is the chief cause of the pain. In severe cases it is necessary to urinate frequently, sometimes as often as every few minutes, day and night; and as the relief obtained is often slight or of short duration, the patient is almost constantly tormented and thus deprived of much needed rest and sleep. In milder cases, urination may be necessary only every hour or two during the day and two or three times at night. The pain is felt deep in the lower part of the abdomen or behind the symphysis pubis. It is often of a burning or smarting character, and may extend along the urethra to the meatus. Changes in the character of the urine are always present. The old idea that cystitis was always associated with ammoniacal urine is an error. The reaction depends upon the kind of infection present, and we may have a severe cystitis with a constantly acid urine, as shown under Bacteriology.

When the cystitis is due to a urea-decomposing microbe, the urine is alkaline, ammoniacal, and irritating, and contains the usual triple phosphate crystals. More or less pus is always present. It may vary from microscopical quantities to sufficient to produce a slight turbidity of the urine, or to from 10 to 25 per cent by bulk upon sedimentation. The urine contains an increased amount of mucus. Numerous squamous and transitional epithelial cells from the bladder mucosa are always

found on microscopic examination, and a few blood cells are common. In acute cases, a drop or two of blood is often squeezed out at the end of urination by the spasmodic action of the bladder. In so-called gangrenous or sloughing cystitis, shreds of mucous membrane may be passed. The ordinary case of cystitis is unattended by any material elevation of the temperature, but in case of abscess formation in the wall of the bladder, of pericystitis, or of extension of the infection to the kidneys, fever may become a prominent symptom. The only difference between acute and chronic cystitis is simply one of time, as the symptoms and causation may be the same in each. The acute form frequently passes imperceptibly into the chronic, and chronic cases are subject to repeated acute exacerbations. Acute cystitis may be expected to subside under proper care in from a few days to two or three weeks, while the chronic form may persist with varying intensity for months or years. The great danger in cystitis is the extension of the infection to the kidneys. More remote is the possibility of perforation of the bladder with infection of the peritoneum or the formation of pericystic abscesses. As similar symptoms and changes in the character of the urine may occur in diseases of other portions of the urinary tract, the diagnosis of cystitis must rest upon a demonstration of the lesions of the vesical mucosa or upon establishing the fact that the pathologic elements found in the urine have their origin within the bladder. These facts are determined by palpation of the bladder, by the use of the cystoscope, and by segregation of the urines. Upon bimanual palpation, the bladder will be found to be sensitive if inflamed; and if the inflammation has been of long duration, the increased thickness of the walls can be easily felt. By the use of the cystoscope, either the Kelly tube or the electro-cystoscopes, the various alterations already described under Pathologic Changes may be easily recognised and an absolute diagnosis made. By ureteral catheterization or the use of the urine segregator, the condition of the kidneys, as separate from the bladder, may be determined, but the danger of infecting a healthy kidney with the ureteral catheter in the presence of a septic bladder should always be remembered. The diagnosis is not complete without a bacteriological examination to determine the nature of the infection. The general health in mild cases may be but little affected, but in severe cases the prolonged, almost continuous suffering often greatly reduces the patient.

Treatment.—As the bladder possesses considerable reparative power provided the predisposing factors mentioned under Etiology are removed, each case of cystitis should be diligently studied in order to discover and abate, if possible, all such factors as favour infection or diminish the resisting power of the bladder. Attention should thus be directed to infections about the vagina, vulva and urethra; to strictures of the urethra, or other causes of obstruction to the free escape of urine; to intrapelvic infections or tumours that press upon or distort the bladder; to intestinal diseases that may permit direct or indirect

infection of the bladder; to septic foci in the kidneys producing descending infection; to abnormal, irritating conditions of the urine, and to foreign bodies or tumours in the bladder, etc. Having relieved these conditions, so far as possible, attention may be directed to the bladder itself. In acute cases, the patient should be confined to bed. An abundance of water should be given to dilute the urine, and potassium carbonate, citrate, or acetate, to reduce its acidity. The food should be very light and mostly of a liquid character. Hot applications to the hypogastric region and vulva afford some relief to the pain, as do also hot sitz baths, and hot vaginal douches. The pain and burning during urination may be ameliorated by having the patient urinate in the sitz bath or while taking a vaginal douche. In severe cases, morphine or codeine may be necessary to relieve the pain. An excellent combination is salol, 3 grains, with codeine, $\frac{1}{8}$ to $\frac{1}{4}$ of a grain, every two or four hours. In the early stages of very severe acute cases, vesical instrumentation should be avoided; but after the most acute stage has subsided, or in milder cases from the beginning, a vesical douche of warm 2-per-cent boric-acid solution gently and carefully given will be found of great service. In chronic cases, the bladder should be cleansed by irrigation daily with warm boric-acid solution, or formalin 1 to 2,000 or 3,000 in normal salt solution; mercuric bichloride, 1 to 10,000 or 20,000, or silver nitrate 1 to 1,000 or 2,000. In all cases, the interior of the bladder should be inspected, and where the changes are found to be circumscribed, direct application of a 2-per-cent to 3-per-cent solution of silver nitrate should be made to the diseased areas. In tuberculous cystitis with ulceration, the ulcers may be curetted and from 2 to 4 drachms (8 to 15 cubic centimetres) of iodoform emulsion (10 per cent) allowed to remain in the bladder. Internally, such remedies may be given as have been found to exert an inhibitory action on the growth of the microbes while being eliminated with the urine. Of these, salol and urotropin are the best, the former in doses of 5 grains (0.3) four to six times a day, and the latter of from 7 to 10 grains (0.5 to 0.7) three times daily. The diet should be regulated, and all irritating articles of food and alcoholic drinks interdicted.

Should the above means fail to give relief, complete rest to the bladder should be secured by continuous drainage either by the catheter *à demeure* or by suprapubic cystotomy.

Hyperæmia.—Under the terms hyperæmia, irritable bladder, neuralgia of the bladder, etc., has been described a condition which is quite common in women, and often very troublesome. While it is possible that a neuralgia of the bladder may occur, the term is entirely unsuited to the condition at present under discussion. Of the other two terms mentioned, hyperæmia seems the more appropriate, although it is quite impossible to draw a sharp distinguishing line between a simple hyperæmia and a mild cystitis. If the cases of so-called "irritable bladder" are examined with the cystoscope and the

endoscope, changes quite typical of a mild inflammation will be observed in a large majority of them. These changes are usually quite circumscribed in outline. They may be limited to the trigone (trigonitis) or to a small area about one or the other ureteral opening. Most frequently, the vesico-urethral junction, or that portion which first begins to fold over the end of the endoscope as it is withdrawn from the bladder, will be found involved. These areas are quite red, often swollen or slightly œdematous, very sensitive when touched with the end of a probe or applicator, and, at times, they bleed easily, particularly the above-mentioned vesico-urethral junction. Many of these cases are undoubtedly due to a mild infection, and the question of infection is the only distinguishing point between a simple hyperæmia and a beginning true inflammation. Women with chronic uterine displacements are common sufferers in this way, and Harris has seen a number of cases in spinster seamstresses who use the sewing machine to excess, and in women with movable kidneys. A neurotic element is often strongly marked, and many times the vesical symptoms are but a part of a general neurasthenia. The symptoms are a frequent desire to urinate, with a burning or smarting sensation accompanying or following the act. The discomfort often becomes quite distressing. Remissions, or even intermissions, in the symptoms are quite common. The *treatment* must be governed by the etiologic conditions present. Uterine complications must be corrected; and concentrated and irritating urine must be diluted and modified by giving plenty of pure water and such diuretics as potassium citrate, with triticum repens or stigmata maidis. Codeine may be added if the pain is severe. The neurotic element, when present, must be duly considered and treated with proper diet, tonics, exercise, etc. The local treatment consists in irrigations with warm boric-acid solution, 2 per cent, or the direct application through the cystoscope of a 2-per-cent to 4-per-cent solution of silver nitrate to the hyperæmic patches. In many cases, particularly in those associated with a nervous element, dilatation of the urethra is followed by marked improvement.

Foreign Bodies in the Bladder.—By the term foreign bodies is meant, not only such articles as are wilfully or accidentally introduced from without, but also such as originate within the bladder. Under the latter division are to be considered vesical calculi. These, as primary formations, are very rare in the female. Most primary bladder stones have their origin in small calculi that descend from the kidneys and, failing to escape from the bladder, gradually enlarge by the further deposit about them of the urine salts. The rarity of such stones in the female is due to the short, dilatable urethra which readily permits the escape of any concretion that may enter the bladder through the ureters. Whenever, therefore, a primary stone is found in the female bladder, it is usual to find some antecedent condition present which interferes with the prompt and complete evacuation of the urine. Among such conditions may be mentioned strictures of the ure-

thra, either from cicatricial contraction or pressure from without; tumours within the bladder which interrupt the escape of the urine; pouching of the bladder, such as occurs in diverticula and cystocele; distortions or displacements of the bladder from intrapelvic tumours; adhesions of this organ to neighbouring parts, which interfere with its free contraction, etc. In the presence of any of these conditions, a concretion descending from the kidney may remain in the bladder and develop to a stone of considerable dimensions. As such stones are identical in origin and structure with those that develop within the kidneys, the reader is referred to the article on Renal Calculi for their etiology and composition. By far the large majority of vesical calculi in the female are not of the so-called primary variety, but develop as secondary formations about foreign bodies that have been introduced from without. Most of such bodies enter the bladder through the urethra, but other routes are possible; a pessary, for instance, may ulcerate from the vagina into the bladder; ligatures placed in the bladder wall, or even about pedicles in the pelvis, may find their way into the bladder; particles may enter from the alimentary canal in vesico-intestinal fistulæ; pieces of bone, clothing, etc., may be carried to the bladder by bullet wounds, etc. As already stated, however, the urethra is the most common route, and of 391 cases of foreign bodies in the bladder collected by Dénucé, 258 were introduced intentionally, that is, out of morbid curiosity or for masturbating purposes. Among the various articles thus introduced, may be mentioned hairpins, glass-headed pins, beads, pieces of lead pencils, slate pencils, chewing gum, straws, small paraffin candles, peas, kernels of corn, etc. Foreign bodies may likewise find their way into the bladder accidentally, as when the end of a catheter breaks off or a whole glass catheter slips in, as mentioned by Kelly, or a lithotrite or other instrument breaks while being manipulated within the organ. A foreign body may remain in the bladder a long time without inducing any special symptoms. Thus, Letulle mentions a case in which a penholder, 8 centimetres long, remained in the bladder three months without producing the slightest trouble, and Steinitz, one where a broken-off rubber catheter remained seventeen years without giving rise to any considerable difficulty. Usually, however, severe symptoms very soon arise. Painful contractions of the bladder may be induced, particularly if the body has sharp points, and perforation of the organ may occur with the development of a fatal peritonitis. Ordinarily, the symptoms are those of a simple cystitis; painful, frequent urination, with blood, pus, and decomposition of the urine. The decomposition of the urine leads to the deposition of phosphates about the foreign body as a nucleus, and thus are developed secondary stones. While the pain is usually more severe after emptying the bladder or following exercise or jolting of the body, and while the amount of blood present in the urine is usually more pronounced than in ordinary cases of cystitis, still the symptoms are

not absolutely characteristic of the presence of a foreign body, which fact must be demonstrated by bimanual palpation, the introduction of the sound, or inspection through the cystoscope.

The *treatment* consists in the removal of the foreign body, whatever it may be. A primary stone, if not too large, may be removed through the dilated urethra, or it may be crushed with the lithotrite and washed out with the evacuator. Much ingenuity must often be displayed in the removal of irregular bodies or those with sharp points. Much, however, may be done through the dilated urethra with the cystoscope and forceps, while the patient is in the knee-chest position and the bladder distended with air. In dilating the urethra, the external meatus should be incised laterally and in the middle line, and the dilatation, which should be made slowly with smooth dilators, should not exceed 18 to 20 millimetres, owing to the danger of producing permanent incontinence. The incisions of the meatus should subsequently be sutured. When the body can not be removed through the dilated urethra, it will be necessary to incise the bladder either from the vagina or above the pubis. The suprapubic route is usually to be preferred, as it affords easy access to the bladder and there is no danger of injuring the ureters or of leaving a permanent vesicovaginal fistula. By distending the bladder with air, the peritoneal fold is well raised up and the organ may be opened without difficulty. The incision in the bladder should be closed with catgut stitches which should not enter the vesical cavity, and a catheter *à demeure* introduced.

Tumours of the Bladder.—As both the entoderm and the mesoderm enter into the formation of the bladder, nearly all varieties of tumours have been found taking origin from its walls. The benign, mature connective-tissue tumours, fibromata, myomata, and lipomata, are very rare, and but few well-marked specimens have been recorded. They have their origin in the submucous and muscular layers.

The malignant embryonal connective-tissue tumours, myxomata and sarcomata, although more common than the benign growths, are still to be classed with the rarer forms. Of the epithelial growths, the carcinomata are much the more frequent, only a few adenomata having been observed. By far the most common tumour found in the bladder is the so-called *papilloma* or villous growth.

The typical villous growth is made up of a number of delicate, slender prolongations which subdivide or branch similarly to an ordinary shrub. Each little prolongation is composed of a central blood-vessel loop, surrounded by a variable amount of loose connective tissue, and the whole covered by several layers of epithelial cells of the vesicle type. While this is the general character of a villous growth, variations may exist in the length and size of the prolongations, number of branches, extent of attachment at the base, amount of connective tissue present, number of layers of epithelial cells on the surface, etc. In size, they may vary from a few millimetres in height and circum-

ference to several centimetres. Much confusion exists in the literature from an attempt to name and classify the papillomata.

A papilloma may exist for years without leading to the destruction of tissue or the patient; it may be removed without displaying the slightest tendency to recur, thus exhibiting every evidence of a benign growth. On the other hand, infiltration and destruction of the bladder walls may result, metastases may form, and rapid recurrence after removal, and death within a short time, may take place, thus exhibiting every evidence of great malignancy. The papillomata may, therefore, be classified as simple, or benign, and carcinomatous, or malignant. The benign growths are usually pedunculated, with narrow bases and without infiltration. The malignant are more sessile, with broad bases and infiltration of the bladder walls. Typical exemplars of these two varieties would perhaps be easily recognised, but unfortunately many atypical cases are found. Cases which show no infiltration macroscopically, may show, upon microscopic examination of serial sections through the base, beginning epithelial inclusions and prolongations from the surface layers. These cases, after removal, show a tendency to recur as typical infiltrating carcinomata. The occurrence of such cases makes it impossible always to determine, from gross appearance alone, whether a papilloma is benign or malignant. It is, therefore, safer to look upon them all with suspicion and to treat them as if they were malignant. Tumours of the bladder may appear at any time of life from infancy to old age. The large majority of tumours in early life are malignant. Steinmetz (*Deutsche Zeitschrift für Chirurgie*, Bd. xxxix, s. 313) collected 32 cases in childhood. There were 14 sarcomata; 13 myxomata; 1 fibromyoma; 1 cystofibroma; 1 rhabdomyoma; and 2 of a nature not stated. The clinical history of the myxomata differed in no way from that of the sarcomata. Concerning the age, there were 23 between one and five years, and only 6 from five to thirteen years. During adolescence and early adult life, tumours of the bladder are very rare; after thirty they again increase in frequency, and are most common from forty to sixty.

Symptomatology and Diagnosis.—In adults, the first symptom is usually hematuria. This is of the so-called spontaneous variety; appearing and disappearing without apparent cause, and usually uninfluenced by exercise or exertion. It may last but a short time or persist for months or years, and may be slight or quite severe. For a time, there may be no subjective symptoms present; sooner or later, however, increased frequency of urination and pain are noted. These are more marked and appear earlier when the growth occupies the base of the bladder or the region near the internal orifice of the urethra. A pedunculated growth in this region may enter the urethra and make its appearance at the meatus urinarius. This has been particularly noted in children, and has frequently been the first symptom directing attention to the bladder. When the bladder becomes

infected, as it is particularly prone to do in malignant cases, the symptoms are those of an ordinary cystitis. In about 25 per cent of malignant cases, the earlier symptoms are those of a simple cystitis. It is impossible to distinguish between a benign and a malignant growth by the symptoms in the early stage, but later, the cachexia, loss of flesh, failure of general health, etc., stamp the case as malignant.

Direct inspection of the interior of the bladder through the cystoscope is the only means of making a positive early diagnosis of bladder tumour. By the use of this instrument, the extent and the general physical characteristics of the growth may be observed. An infiltrating, ulcerating growth is almost certainly malignant, but in the case of a papilloma it will be difficult to decide, and it is better to await the findings of the microscope before expressing a positive opinion. The duration of a benign growth is often one of years, but a malignant tumour is usually fatal in from one to three years.

Treatment.—All tumours of the bladder should be removed as soon as possible. Pedunculated growths may often be removed through the dilated urethra with the snare or galvano-caustic loop, but in the majority of cases the suprapubic route will be found the most satisfactory, as it permits free access to all parts of the bladder and a more thorough removal of the growth. Even in cases that appear benign, it is safer to remove the base freely, as if it were malignant. In infiltrating malignant growths a resection of the bladder walls should be made. This is not so difficult when the mass occupies the fundus, but when the base is involved, or the region about the ureters, it becomes a very serious and difficult operation. The ureters must be transplanted higher up in the posterior wall or fundus. When the organ is extensively involved, it may be necessary to remove it completely. This has been successfully done, and the case of Pawlik may be taken as a model, although the details of each operation will have to be worked out by the operator and modified to suit the individual case. Pawlik turned the ureters into the vagina as a preliminary operation. He then removed the bladder working from above and below, but preserved the urethra which he likewise turned into the vagina. The vaginal opening was subsequently closed and this organ made to supply the place of a bladder. The ultimate result was very gratifying.

Urethral Caruncle.—With the exception of gonorrhœal urethritis, diseases of the female urethra are rare. The conditions most commonly met with are tumours, diverticula, strictures, prolapse, the presence of foreign bodies, and dilatation. Of the tumours, the most common is the urethral caruncle. This usually presents itself as a small red mass projecting from the orifice of the urethra and attached by a narrow pedicle to the mucosa within the meatus. It is often somewhat flattened laterally owing to pressure between the labia. It is composed of connective tissue abundantly supplied with blood vessels

and covered with several layers of flattened epithelial cells. These little growths are usually exquisitely sensitive. Urination is so painful that the act is delayed as long as possible, and, in the married, marital relations are often impossible owing to the acute pain produced by the gentlest touch. They may occur at any age, but are more common later in life. In the presence of such symptoms the diagnosis is easily made by inspection.

Treatment consists in removal. This may be done under local anæsthesia by the application for a few minutes of a 10-per-cent solution of cocaine. The little mass should be drawn out and the pedicle divided close up to the base. Should the base be quite broad, the wound may be closed by stitches.

Carcinoma of the urethra, as either a primary or a secondary affection, is not common. Ehrendorfer (*Archiv für Gynäkologie*, Bd. lviii, s. 463) was able to collect 27 cases from the literature including one of his own. These cases presented three forms: 1. Warty, papillomatous excrescences, developing from the mucosa and projecting from the urethra; 2. Thick, nodular, infiltrating masses in the periurethral tissues, involving more or less of the circumference of the urethra and usually located toward the external end, and 3. Ulcerated surfaces with thickened, irregular and infiltrated edges. These may begin at any point along the canal including the meatus. Enlargement of the inguinal lymph glands was recognised and mentioned in only about one third of the cases. As is usual with carcinoma, the majority of the cases occurred late in life.

The symptoms first complained of, are usually a sense of itching and irritation about the meatus or vulva, due to the irritating, acrid discharge commonly present, and pain or smarting on urinating. The presence of these symptoms should always lead to an examination, when, on inspection, with the aid of the endoscope if necessary, and palpation, one of the above-described conditions, should it exist, will be recognised and a diagnosis made.

The *treatment* is early and thorough removal. The anterior portion of the urethra may be removed and continence of urine remain. Should it be necessary to remove the entire urethra, the bladder may be closed below and a suprapubic opening made after the method of Witzel.

Sarcoma of the urethra has been noted, but the clinical history and treatment do not differ from that of carcinoma (see Neoplasms of the External Organs, Chapter XIX). Of the benign tumours, a few cases of *fibroma* have been described occurring for the most part in little girls. They presented as small polypoid masses protruding from the urethra and attached by a narrow pedicle. Their removal is a simple matter.

Diverticula usually extend from the posterior wall of the urethra toward the vagina. They may vary in size from that of a pea to that of a cavity holding several cubic centimetres. According to Roush,

they originate from the rupture of retention cysts, blood cysts, or periurethral abscesses into the urethra. The distended pocket produces a protrusion, or bulging, of the anterior wall of the vagina, easily seen on separating the labia. Upon pressure, the enlargement diminishes in size and, at the same time, pus or pus and urine escape from the urethra. An examination with the endoscope will reveal a small opening in the posterior wall of the urethra from which the pus escapes, and through which a probe may be passed into the cavity. Owing to the decomposition of the urine, which takes place in the cavity, a calculus may form therein. Most of these cases give a history of long-continued vesical irritation with frequent, painful urination, etc.

The *treatment* consists in opening the sac freely from the vagina, curetting the walls, or painting with tincture of iodine and packing with gauze. Should this not be successful, an attempt may be made to dissect out the sac.

Strictures of the female urethra are quite rare. They are due to cicatricial contraction following injury the result of external violence or lacerations during labour, and they occasionally follow a virulent gonorrhœal infection or the healing of a urethral chancre. They may be easily recognised with the *bougie à boule* and should be treated by gradual dilatation or division followed by dilatation.

Prolapse of the urethral mucosa may follow a difficult labour or may occur in poorly nourished young girls following straining, coughing, etc. In a severe urethritis the mucosa may become so swollen as to protrude considerably. In some cases it is impossible to assign a direct cause for the prolapse. The prolapsed mucosa presents a dark red or bluish mass, which is sensitive and bleeds easily, and in the centre of which may be found an opening leading into the urethra (Fig. 86, Displacements of the Vagina). If allowed to remain long protruded, the mass may become so constricted as to produce sloughing.

Treatment.—An attempt should be made to reduce the mass by gentle pressure. Permanent reduction has followed the application of an ice bag to the parts with the patient in the recumbent position. Should these means fail or should sloughing threaten, the mass may be removed with the knife or scissors, the edges being carefully stitched to prevent hemorrhage and retraction as described under Displacements of the Vagina.

Foreign bodies in the urethra are small calculi that have lodged in attempting to pass from the bladder, or that develop in a dilated or pouched urethra; or they are small bodies introduced from without through the meatus. They give rise to painful and difficult urination, and can be felt by the finger pressing along the urethra through the anterior wall of the vagina or by introducing a probe or catheter into the canal. Calculi are usually of the phosphatic variety. Removal may be effected through the dilated urethra by means of a

small forceps or a wire loop. When lodged in a pocket, it may be necessary to incise the pouch from the vagina in order to reach the stone.

Dilatation of the urethra may occur from the introduction of large bodies from without or the expulsion of calculi or tumours from within. *Coitus per urethram* in women with atresia of the vagina, and the introduction of large foreign bodies for masturbating purposes, have given rise to extreme dilatation with eversion and gaping of the urethral orifice. Severe laceration of the urethra has been produced by attempts at coitus. Fritsch is, therefore, of the opinion that at least a congenital disposition to dilate is present in those cases of extreme dilatation that have occurred without the production of symptoms. More or less incontinence of urine is the usual result in these cases. Upon the slightest straining, such as coughing, sneezing, or making a sudden misstep, urine escapes and soils the patient so that the condition becomes very annoying.

Treatment.—In slight degrees of dilatation, the application of a 10-per-cent solution of silver nitrate to the interior of the urethra has been followed by benefit. The use of astringent vaginal douches and tampons may be tried, or a pessary so constructed as to press on the urethra may be worn. When the dilatation is marked, these means will seldom be found sufficient. It will then be necessary to resort to operative measures. Several procedures have been employed, the most reliable of which are: 1. The removal by an elliptical incision of a portion of the anterior vaginal wall, extending down to, or even including, the wall of the urethra, with closure of the space by transverse stitches. 2. Freeing the distal end of the urethra by dissection and carrying it forward or upward toward the clitoris where it is brought to the surface through a new opening in the vestibule. 3. Gersuny's operation of dissecting the urethra free throughout its entire length and twisting it upon its axis from 180 to 360 degrees. It is then stitched in this position. 4. Fritsch's operation, which consists in removing an elliptical piece from the dorsal surface of the urethra at its junction with the bladder through a transverse incision between the urethra and the arch of the pubis. The urethra is closed with catgut stitches, the wound packed, and the bladder drained by a self-retaining catheter.

The selection of the method of operating will depend somewhat upon the severity of the case. Gersuny's and Fritsch's operations are suitable for the more marked cases.

The urachus is a cordlike remnant of fœtal structure extending from the fundus of the bladder to the umbilicus. It is a portion of the allantoic vesicle, from which were derived the urethra and bladder.

This rudimentary canal consists of three layers: (*a*) an inner epithelial layer; (*b*) a middle basement membrane, and (*c*) an outer fibrous layer. The epithelial layer consists of a variety of cells, corresponding in form and size to those found in various parts of the

urinary apparatus. They are either ovoid or polygonal, and are generally nucleated. The intermediate layer of basement membrane is described by Luschka as being structureless, delicate and transparent. The outer, or fibrous, layer, while attached to the outer side of the basement membrane, is distinctly separated from the surrounding cellular tissue. It will be seen, therefore, that while this structure exists as a blind, and ordinarily functionless, canal, it possesses all the histological elements, to render it a highway of communication. Luschka declares that, in the majority of male subjects, this canal is found to be partially opened, and goes to the extent of stating that it possesses a mucous membrane. If this is true, as it may be in certain instances, the necessity for its patulousness becomes apparent.

Vesico-umbilical fistula is occasionally encountered, and is the result of the failure of the urachus to become closed at both its vesical and umbilical extremities. It is generally observed as a congenital condition, although it has been found in patients of forty and even sixty-six years of age. When urine escapes from the navel, this condition may be premised. A flexible sound can generally be passed without difficulty from the navel orifice into the bladder. The bladder in such cases can be catheterized by this route. While in the majority of cases this condition is congenital, there are instances on record in which an opening has been forced through the urachus, by retention of urine. Atresia of the urethra, due to gonorrhœa, prostatic enlargement, and phimosis, has been recorded as a direct exciting cause of vesico-umbilical fistula. The *treatment* consists in removing the urachus by abdominal section. A median incision should be made from the umbilicus to near the pubis; the canal should then be dissected out and its lower extremity ligated. As a precaution against the extravasation of urine into the peritoneal cavity, it

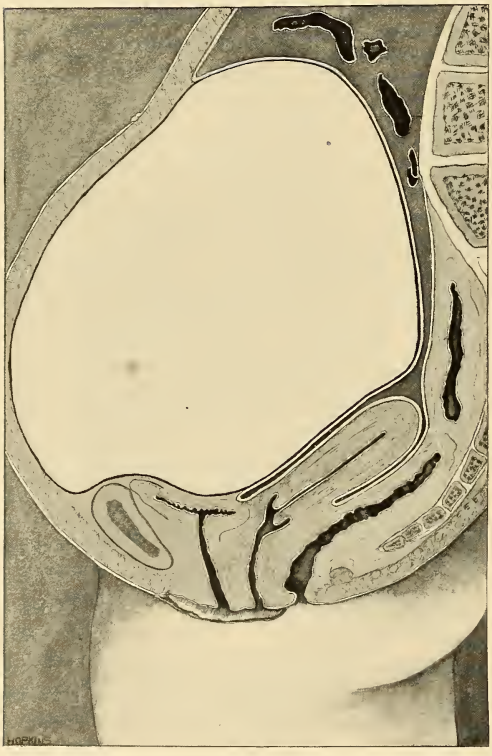

Fig. 321.—"The sac extended from near the ensiform cartilage to the pubes."—Reed (page 805).

is well to fix the pedicle of the urachus in the lower angle of the abdominal incision. Before undertaking the operation, it is well to observe the admonition of Douglas, by making sure that the calibre of the urethra is sufficient to enable the urine to escape.

Cyst of the urachus may result from an occlusion of both the umbilical and the vesical ends of the canal, secretion from its mucous surface, as described by Luschka, presently converting it into a retention cyst. The fluid in these cases rarely, if ever, possesses any urinary elements, and must, consequently, be derived from the wall of the sac. In a case under Reed's observation, the sac extended from near the ensiform cartilage to the pubes and forced the viscera from their normal positions (Fig. 321). The cyst was enucleated without opening the peritoneal cavity. Similar cases have been reported by Douglas and Alban Doran, and, previously, by Tait, Wolf, Ill, Freer and others. The condition may be, and generally is, mistaken for an ovarian cyst. The facts, however, that it is immovable, that it occupies a median position, and that it has generally been a long time developing, should suggest its urachal origin. Cysts of minor size generally elude detection until they are encountered incidentally in the course of an abdominal operation undertaken for another purpose. The treatment of these tumours is by abdominal section. The sac should be carefully enucleated. If ordinary precaution is taken in this manipulation, the peritoneal cavity need not be invaded—at least in the majority of cases. In a number of cases on record, it has been possible to enucleate these sacs without discovering a pedicle, thus showing that the connection between the urachus and the bladder had been broken up—probably in the course of evolution.

CHAPTER L

THE RECTUM

Malformations—Examination—Displacements—General etiology of rectal disease —Relation of intrapelvic disease to disease of the rectum in women.

The **rectum** is the lower segment of the alimentary canal and extends from the sigmoid flexure to the anus. It passes from opposite the left sacro-iliac synchrondrosis, from left to right, to near the middle of the sacrum, whence it descends in the median line to the anus. It is narrower at its intestinal than at its anal end. Its upper portion is covered by peritoneum, which constitutes the mesorectum; its muscular layers are two in number, one of longitudinal fibres, beneath which are circular fibres comprising the sphincter ani internus. The rectum is lined with a mucous membrane which is united with the muscular layer by connective tissue and is covered with columnar epithelium, being raised into crescentic longitudinal folds called the columns of Morgagni, or the transverse rectal folds. The rectum is held in position by the mesorectum, by its connections with the circumrectal tissues in its lower third, and by the muscular apparatus embraced in the two layers of the pelvic floor. (See The Pelvic Floor.)

Malformations of the rectum and anus are of more frequent occurrence in male than in female children. They may, according to Bodenhamer (*New York Medical Journal*, May 25, 1889), consist of (1) a preternatural narrowing or stenosis of the anus at its margin, occasionally extending a short distance above this point; (2) complete occlusion of the anal aperture by a simple membrane or by the common integument or a substance analogous to it, more or less thick and hard; (3) absence of the anus with partial deficiency of the rectum, which terminates in a cul-de-sac at a greater or less distance above its natural outlet; (4) a normal anus associated with a rectum which, at variable distances above, is either deficient, obliterated, or completely obstructed by a membranous septum; (5) a rectum terminating externally by an abnormal anus located in some unnatural situation, e. g., the sacral region, the perineum, within the fourchette, etc. (see Malformations of the Vulva), the abnormal anus thus formed being deficient in functional power; (6) the rectum opening into the bladder, urethra or vagina, or into a cloaca in the perineum with the urethra and the vagina; (7) a rectum normal in itself, but having the ureters, the vagina or the uterus opening abnormally into it; (8) complete absence of the

rectum; (9) absence of both the rectum and colon and the termination externally of some other portion of the intestinal canal in an abnormal anus in some extraordinary part of the body; e. g., the umbilicus, the left iliac fossa, the lower part of the abdomen just above the symphysis pubis, below the scapula, and at the side of the face, for it has been known to occupy each of these situations. In the last-named class no normal anus ever exists.

The *prognosis* of congenital malformations of the rectum and anus must depend largely upon the character of the malformation. As indicated in the preceding paragraph, these malformations vary greatly. It may be stated as a rule, however, that classes (3) and (4) are of relatively more frequent occurrence than the others, and to them alone special attention will be given in this chapter. Whenever the malformation is of such character as to obstruct the fæcal current, the condition, if not overcome, must necessarily result in death. Without reference to the classification of cases, out of 345 patients upon whom operations had been performed, 160 recovered. This is an encouraging outlook, particularly when the desperate character of the cases is taken into consideration, and when it is remembered that many of the cases embraced in this table, compiled by Bodenhamer, were operated on in the preantiseptic era. Matas (*Transactions of the American Surgical Society*, 1897), in a valuable contribution on Anorectal Imperforation, the condition designated in Bodenhamer's third and fourth classes, emphasizes the fact that, in the development of this condition, the rectum and anus have simply failed to meet in the process of development. There is defective development of either the proctodæum or enteron, leaving the rectal pouch of the colon at a distance varying from a few millimetres to 5 or more centimetres from the perineum; or the enteron may be entirely absent and remain out of the pelvis altogether.

The *symptoms* of imperforate anus consist in an absence of the fæcal discharge and in restlessness, which may develop into spasms of the infant. Abdominal distention speedily ensues, but before this occurs, the vigilance of the nurse will have detected the true condition of affairs. The diagnosis of the condition within the pelvis, however, is far more difficult, if, indeed, it is not impossible. Probes, sounds, or guides, passed into the vagina or bladder, and the use of the aspirating needle, are equally fallacious.

Treatment consists in establishing the fæcal current. This may be done, by establishing an anus either at its normal situation, or in the inguinal region. Matas gives it as an axiom, that it is the duty of the surgeon to presume that there is a rectal pouch in the pelvis and, if possible, to make an anal connection with it. This presumption is based upon the fact made apparent by Bodenhamer's table, namely, that the rectum and colon were totally absent in only 41 out of 465 cases. Whatever is done in these cases should be done early. Delay based upon the theory that infants can not resist traumatism, and that in these cases it is better to give them time in which to acquire strength,

is a fatal and tragic fallacy. Delay under such circumstances means, not only the wasting of the child's strength, but the development of peritonitis followed by stercoræmia and death from exhaustion. The object of an operation should be to establish, if possible, an intestinal outlet in its normal situation in the perineal sacral region with sphincteric control. This should be accomplished by means of proctoplasty—i. e., by dissection down upon the rectal pouch and its fixation to the cutaneous margin. In making this section, it may be necessary to carry the incision well back to the coccyx or even up into the sacrum. If, after making this incision, it is found to be impracticable to attach the terminal portion of the colon (rudimentary rectum) to the external wound, it is justifiable in the emergency to attach the small bowel. Matas states that a median or lateral or exploratory abdominal section is indicated when, after the intraperitoneal exploration through a perineal sacral incision, it is evident that the terminal cul-de-sac of the rectum or any portion of the colon can not be brought down to the pelvic outlet, and that only the small intestine is available for proctoplasty. The aim of the operator, after making an exploratory abdominal incision, according to Matas, should be to guide the colon, the cæcum or the most available loop of the ileum, to the perineosacral wound, where it can be drained permanently with greater safety. The perineosacral anus, if the operation has been properly performed, is almost certain to be voluntarily controlled in the course of time. Keen (*Medical Mirror*) suggests inguinal colostomy as the operation of choice in imperforate rectum, affirming that it is safer to life and has the additional advantage of being done with facility, there being no groping in the dark in a narrow wound, while the time consumed is much shorter. In this suggestion, Keen follows in the footsteps of Chassaignac, Lannelongue and others, who, however, looked upon the inguinal operation as a tentative measure, to be followed later by a perineal operation for the establishment of an anus at its normal situation.

Fig. 322.—"The surgeon is to close his hands and to point his index fingers."—Martin (page 809).

The Examination of the Rectum.—*Noninstrumental Proctoscopy.*—The essentials of this method are a patient, an assistant, and an operator

having at least one finger on each hand. The patient is to be put into the knee-chest posture; the assistant is to place and to hold the patient; and the surgeon's fingers are to be used to open the anus, all in the following manner, to wit:

1. The patient is to be completely anæsthetized as she lies on her back, and then turned toward the assistant and into the Sims posture. 2. The assistant is to station himself at the patient's knees. In his left hand he is to grasp the patient's feet. He is to lean himself against the patient's knees. He is to pass his right arm under the patient's hips. Now steadying the feet and bearing himself firmly against the patient's knees, with his right arm he is to lift the hips and pull his subject into the knee-shoulder posture.

Fig. 323.—"The wrists are to be crossed . . . and the nails of the index fingers placed one against the other."—Martin.

Here, securely held in the embrace of the assistant, the patient is to be balanced on her perpendicular right thigh, where, throughout the whole time of the surgeon's manipulations, she must be steadily held. (A Simplest Proctoscopy, Martin, *Journal of the American Medical Association*, August 27, 1898). 3. The surgeon is to close his hands and to point his index fingers (Fig. 322). The wrists are to be crossed, the hands placed back against back, and the nails of the index fingers placed one against the other (Fig. 323). The surgeon is to lubricate these fingers and gently insinuate them through the anus and place their ends beyond the borders of the levatores ani. This accomplished, the anus is to be kneaded and divulsed in the direction of the ischial tuberosities, by the surgeon forcibly parting his fingers as is shown in the accompanying illustration (Fig. 322). Under this manipulation the rectum becomes atmospherically inflated.

Now, provided the surgeon lowers his head to the level of his fingers and then rises again, or stoops, or moves a little from side to side, he may command under his eye a view of the atmospherically inflated rectum to the depth of 6 or 8 inches (15.24 or 20.32 centimetres), and, in some instances, he may behold even a part of the sigmoid flexure. It is possible for the operator to manipulate his patient and to finish

his inspection within two and a half or three minutes, provided the patient is in a state of complete anæsthesia.

If this method is practised, as it may be with facility by the general practitioner, the greater number of rectal diseases may be instantaneously diagnosticated. But at diagnosis the achievement of the simplest proctoscopy ends, for the reason that the operator's hands are so full of his patient he can do nothing at all for the disease that he may have discovered.

In some conditions, and amid some circumstances, the rectum will not become inflated. If there is a close stricture of the rectum; if there is malignant growth or other disease of the rectum, by means of which the gut's coats have become extensively filled and fixed with an organized plastic exudate; if for some reason the intra-abdominal pressure is abnormally increased, as it may be by the bearing down of the patient, by enormous intestinal flatus, or by ascites; or if there is an impinging uterus, an extrarectal growth or extensive infiltrating

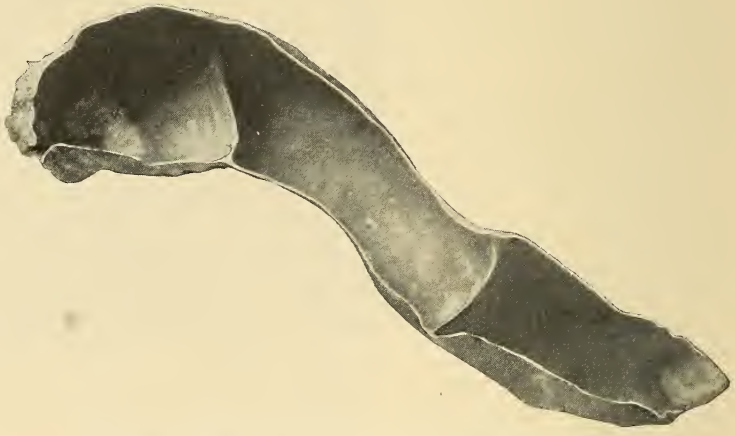

Fig. 324.—"A section through a hardened rectum."—Martin.

disease of the contiguous textures, rectal inflation by this method, or by any other which is governed by the same principle, is a physical impossibility. But this need not baffle the man bent on seeing by instrumental aids.

Practised as described, when not embarrassed by the exceptions specified, this method will achieve its purpose and reveal to the surgeon that the transverse diameter of the rectum is variable. Martin has demonstrated this variation by means of a section through a hardened rectum, with the body in Martin's posture (Fig. 324). While in some places it is not more than an inch (2.54 centimetres), in others it is more than four times as much, in diameter.

The rectum may present to the eye of the imaginative observer the appearance of a chain of urinary bladders, communicating one with another by means of irregularly elliptic openings set at varying

axes, and bounded by the nonparallel borders of the rectal valves. In the normal rectum, the air pressure smooths the mucous membrane evenly over the entire surface of the gut. The normal mucous membrane of the so-called ampulla appears at first wet and of a shining bluish gray. As it dries, under the influence of gravitation the blue venous tint fades out of the gray, and the wall becomes pink-tinged; presently, it assumes the appearance of parchment, and sometimes it appears painted at rare intervals with ramifying little arteries which are crowded and overlapped by the larger companion veins; the latter are less arborescent and more suddenly dive and disappear in the bowel wall. In time, there comes a sheen over all, and the vascular pictures fade. These phenomena appear exactly as described only in the healthy rectum; in the diseased organ the colour varies much.

Should the operator deviate from the prescribed directions for the manipulation of his fingers, and so twist his hands as to divulse the anus in the antero-posterior direction instead of laterally, he invites defeat upon himself; for, in the male, the fixation of the perineum and the immobility of the coccyx interfere with the requisite dilatation; while in the female, the extreme mobility of the perineum, and particularly the backward displaceability of the coccyx, will allow such traction to be made upon the levatores ani as to pull their inner borders parallel and almost together; and, in consequence, the wider the female's anus is opened antero-posteriorly, the closer it shuts laterally to rob one of one's view.

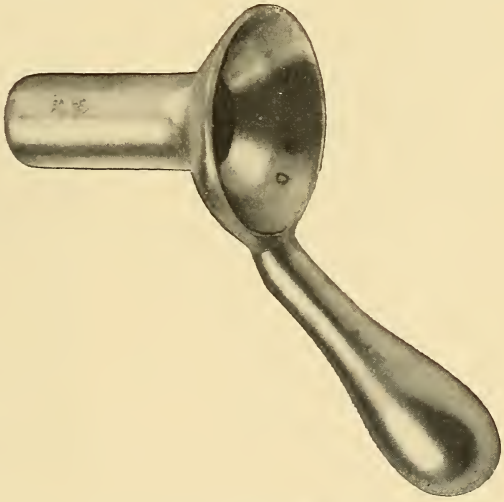

Fig. 325.—"Thomas Charles Martin's anoscope." —Martin (page 812).

Instrumental Proctoscopy.—Special paraphernalia and much practice in their use are necessary for a rapid, painless and complete inspection of the rectum.

The chair which is shown in the illustrations * was designed by Dr. T. C. Martin, of Cleveland, to facilitate the placing of the patient in a new posture equivalent to the knee-chest posture. This improvement on the Yale

* Much of the mechanism of this excellent invention is necessarily omitted in the small drawings to which alone space can be given. The reader is referred to Dr. Martin for further particulars.—Editor.

chair consists of a knee-piece which is fixed to the left arm, of a mechanism attached to the running-gear which provides for the new movements, of a shoulder-strap, and of an illumination apparatus which is susceptible of adjustment in an infinite number of positions.

Thomas Charles Martin's anoscope (Fig. 325) consists of a short cylindrical tube open at the ends. It is 2 inches (5.08 centimetres) in length and $\frac{7}{8}$ of an inch (2.22 centimetres) in diameter. The proximal end is provided with a trumpet-shaped expansion and a strong handle. The distinctive feature of this anoscope is the peculiar form of its obturator (Fig. 326), which has a capacity for a multiplicity of uses.

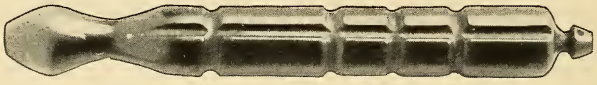

Fig. 326.—"The distinctive feature of this anoscope is the peculiar form of its obturator."—Martin.

The obturator consists of a hard-rubber cylinder, in the middle of which is fixed a brass tube for purposes of irrigation. Its surface is fluted in such a manner that it may be made to lock in any of several positions upon a tubercle within the cylinder. These flutes also provide for escape from the rectum of fluids and gases under certain conditions. The contracted neck near the distal end of the obturator provides a cup to facilitate the application of ointments to certain rectal areas (Fig. 327). This contracted neck is a feature which contributes to the instrument's usefulness as a means for irrigation; providing, in the one case, a self-retaining direct-flow irrigator, and, in the other case, when locked in proper position, an unobstructed return-flow irrigator. Platinum pins connect the centrally placed brass tube with the surface of the neck of the obturator, thus making the instrument an anal electrode.

Fig. 327.—"The contracted neck . . . provides a cup to facilitate the application of ointments."—Martin.

The proctoscope (Fig. 328) is of the same diameter as the anoscope and is 4 inches (10.16 centimetres) in length, which, because of the displaceability of the pelvic floor, is usually sufficient for it to reach as high as the promontory of the sacrum, except in some special instances.

Special preliminary preparation of the patient is ordinarily not required, as the usual condition of the rectum is that of emptiness. In

some cases, however, it facilitates the inspection if the patient employs rectal lavage an hour before the examination.

The Technique.—Step I: The patient should be required to sit on the operating chair with her body turned to the left and facing the knee-board. The right knee should be crossed over the left knee, the left arm should embrace the right border of the chair-back, or it may be folded at the side as for Sims's posture. The small pillow should be held in the patient's right hand, and against and upon her left shoulder (Fig. 329).

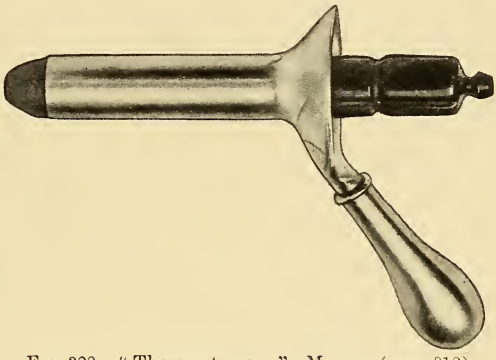

Fig. 328.—"The proctoscope."—Martin (page 812).

Step II requires that the chair be changed to the horizontal position and the light fixture adjusted (Fig. 330). This movement brings the patient into Sims's semiprone-semiflexed posture without requiring any movement whatever on the part of the patient

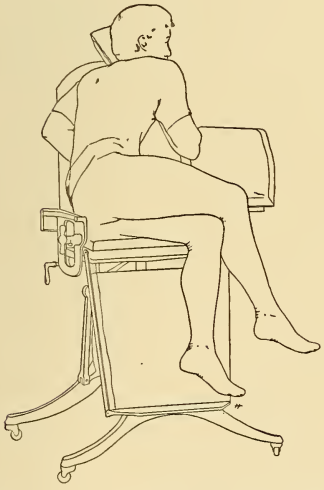

Fig. 329.—"The patient should be required to sit on the operating chair."—Martin.

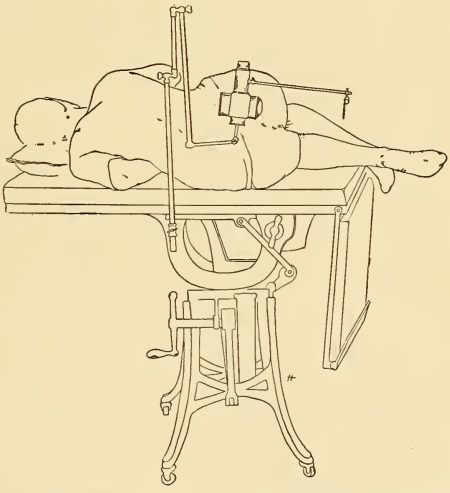

Fig. 330.—"Step II requires that the chair be changed to the horizontal position."—Martin.

after she is properly seated. In this posture the external anus and fixed rectum are to be examined.

(*a*) Digital and ocular inspection should now be made of the anal verge, the external anus, and the superficial ischiorectal space at a moment when the patient is relaxed, and again when she is bearing down.

(*b*) Digital examination of the fixed or anal rectum, also, should be made a preliminary to the introduction of the anoscope.

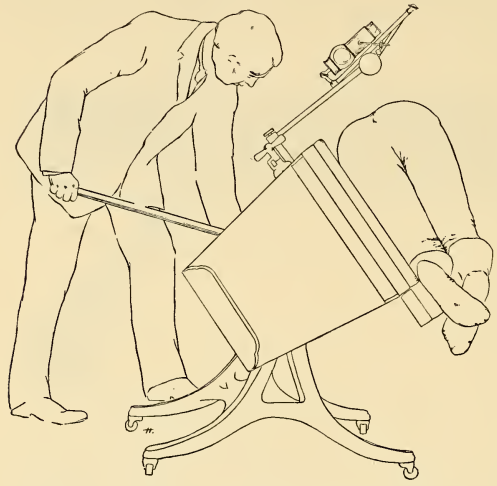

Fig. 331.—"The chair should be tilted."—Martin (page 815).

(*c*) The anoscope should be gently pressed into the anus in the direction of its axis till the sphincters relax to receive it. The introduction of the instrument may be much facilitated by holding its lubricated end against the sphincter and requiring the patient to bear down; bearing down expands the ental sphincter, relaxes the levator ani, thins the pelvic floor or shortens the fixed rectum, and presses the rectal sphincter over the instrument—in other words, the patient's anus is made to climb down upon the instrument. After the introduction of the anoscope, its obturator should be removed and the inspection made. The observations should be made coincident with the withdrawal of the anoscope. In instances of extremely sensitive ani, hypodermic injection into the sphincters of 10 or 20 minims of one-tenth-of-one-per-cent solution of cocaine will render anoscopy painless.

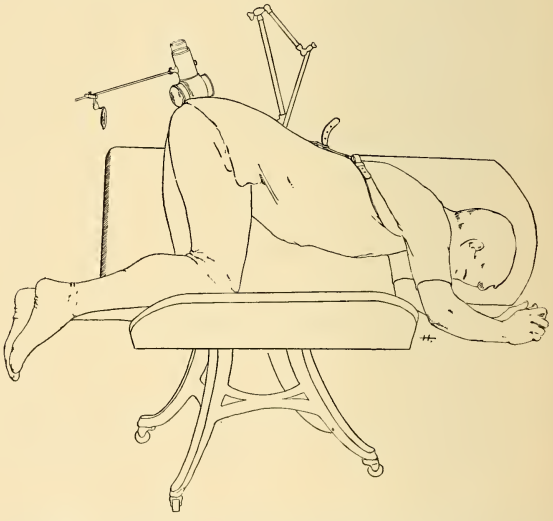

Fig. 332.—"The extreme oblique lateral position."—Martin (page 815).

A desire for precision requires that lesions of the fixed or anal rectum should be noted as occupying a given quadrant, and as situated at a given zone, e. g., *a circumscribed disease may be described as situated at the ental sphincter zone and in the left lateral quadrant.*

Step III requires (*a*) that the shoulder strap should be placed and fixed to the chair, that the knees should be drawn up so that the thighs are at a right angle to the length of the chair-top, and that the chair should be tilted (Fig. 331) to the extreme oblique lateral position (Fig. 332). The leg-foot-board should now be lowered, and the operator's stool placed in position. The illumination apparatus should next be adjusted as illustrated. In this new posture, which is equivalent to the knee-chest posture, the abdominal rectum is to be examined.

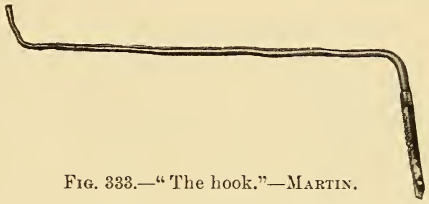

Fig. 333.—"The hook."—Martin.

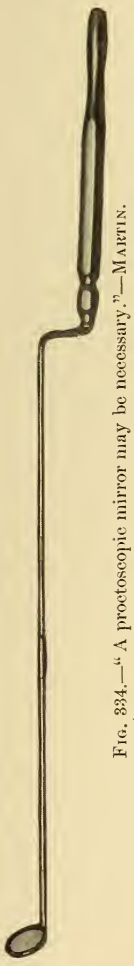

Fig. 334.—"A proctoscopic mirror may be necessary."—Martin.

(*b*) Introduction of the proctoscope requires supported eversion of the buttocks and steady gentle pressure of the well-lubricated instrument upon the anus in the direction of the umbilicus, until the sphincters are felt to yield; or the patient may be required to bear down to take the speculum. As the instrument enters the inflatable movable rectum, it should be pointed toward the promontory of the sacrum and subsequently into the sacral hollow. The withdrawal of the obturator is followed by atmospheric inflation of the rectum.

(*c*) The operator should observe the degree of rectal distention, the situation and number of the rectal valves, their propinquity to one another when passive, and the relation of one valve to another at the time of the patient's bearing down. Under pressure of the proctoscope, if possible, or the hook (Fig. 333), if necessary, each valve should be effaced or displaced, and in regular order each of the rectal chambers should be carefully inspected. A proctoscopic mirror may be necessary for viewing the supravalvular surfaces (Fig. 334).

The examination being finished, we proceed to—

Step IV: The proctoscope should be withdrawn, the illumination apparatus fixed in the first position, the leg-foot-board lifted to its place, the lever extended, the crank turned, and the chair carried back to the horizontal and upright positions; the patient being thus returned to her feet by the execution in the reverse order of the several steps described.

This method of inspection does not subject the patient to struggle or strain and need excite no embarrassment.

Observation by this method teaches that, in nearly all cases of disease at the anus, there is congestion of the rectal mucous membrane, and that, not unusually, a diffused proctitis attends anal disease.

Those cases in which there is no apparent lesion at the anus, and which are in a perfunctory way sometimes declared to be catarrh of the rectum, will at once have their real cause, such as a high-up rectal polypus or a congenital or organic stricture or ulceration, positively diagnosticated, and will be made accessible for intelligent treatment.

New growths or ulcerations may be seen and, by means of a long-handled curette, scrapings made, in order that the microscopist may determine their exact character.

Vesico-rectal, vagino-rectal, and deeper rectal fistulæ, are often apparent at a glance, but, in any case, may be discovered by the use of the proctoscopic mirror.

The existence of stricture of the rectum need no longer be regarded as only doubtful, and this method proves positively, even to the casual observer, how fallacious is the rectal sound as usually employed in the diagnosis of stricture. It has been repeatedly shown how easy it is for an entering or returning bulb-sound to be caught and held by the rectal valves, and to elicit those signs which are generally considered diagnostic of organic stricture of the rectum.

The rectal valve constitutes the chief topographical feature of the abdominal rectum. Its histologic character indicates it as the typical anatomic valve (Fig. 335). The attached border of each valve spans a little more than half the circumference of the rectum, and its free border projects half way across the diameter of the inflated rectum. Thus, what has heretofore been regarded as a cavernous ampulla, is seen to be divided into several chambers. There are as many chambers in the rectum as there are rectal valves. The number of rectal valves is variable. Some subjects have but two, others have four, but 90 per cent of persons possess three. The uppermost valve is invariably situated at the juncture of the rectum and the sigmoid flexure, and is usually on the left wall; the next is on the right, and the lowermost on the left wall. The positions of the lower two valves are sometimes anterior and posterior respectively. It must be readily seen that the newer methods of rectal inflation for rectal inspection will determine newer notions of the topography of this part, and will justify consideration of the lowermost chamber as the first rectal chamber; of the cavernous area beyond the first valve and be-

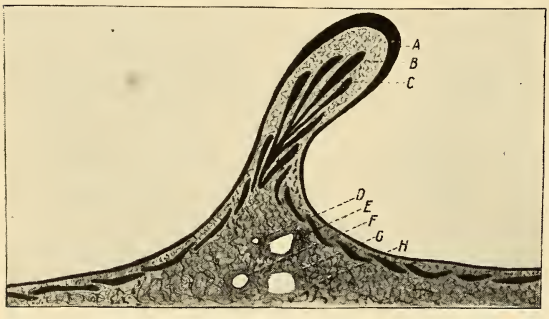

Fig. 335.—"The typical anatomic valve." *A*, mucous membrane; *B*, fibrous tissue; *C*, bundles of circular muscular fibres; *D*, *F*, arteries; *E*, *G*, veins; *H*, areolar and adipose tissue.—Martin.

low the second, as the second chamber; and of the upper chamber as the third or perhaps the fourth, according to the number of valves. The ancient arbitrary division of the rectum by the anatomists into upper first, middle second, and lower third parts, should be abandoned (Fig. 336).

Fig. 336.—"The ancient arbitrary division of the rectum should be abandoned." (Laparosymphysiotomy, showing the rectum packed with scybala.)—Martin.

If this method of ocular examination is practised, there need be no longer any excuse for calling an undiagnosticated disease of the rectum an "obscure disease"; and, whatever the disease present, this method makes it susceptible of demonstration to the patient's physician or attendant friend. There is no necessity whatsoever that the diagnosis of rectal disease be taken on faith. (Complete Inspection of the Rectum, Thomas Charles Martin, M. D., *American Gynecological and Obstetrical Journal*, December, 1898.)

Displacements of the rectum in women may be classified as (*a*) anterior, (*b*) posterior, and (*c*) prolapse. Anterior displacement consists of the sacculation forward of the anterior wall of the rectum. This constitutes the condition of rectocele (see Rectocele), or more specifically *anterior rectocele*. It necessarily implies an equal displacement of the posterior wall of the vagina. The condition is generally induced by either dilatation of the vaginal outlet or injury of the pelvic floor. It is treated as prescribed in the chapter on Repair of Surgical Injuries of the Floor of the Pelvis.

Posterior displacement of the rectum consists in the sacculation, posteriorly, of the posterior wall of the rectum, and is, in reality, a *posterior rectocele* (Fig. 337). This condition which is not frequently recognised, is, nevertheless, one of relatively common occurrence. Its symptoms consist of more or less rectal tenesmus and difficulty in defecation, there being a constant sense of the presence of residual fæces after an effort at dejection. If the bowel is loaded with hardened fæcal matter, much difficulty is experienced in discharging it, the effort being attended with a feeling of retro-anal protrusion. If a patient afflicted with this condition is placed in either the dorsal or the semiprone position and is asked to strain, a fulness behind the anus will be apparent. Rectal exploration by the finger will reveal a posterior sacculation of the rectum, just within the external sphincter,

and associated with a diminution or a disappearance of the normal constriction due to the proper action of the levator ani muscle. The *pathology* of this condition is essentially that of the dilatation of the rectum and is due to either a relaxation or an injury of the deep muscular layer of the pelvic floor. When the levator ani has once been damaged, and the rectum has been deprived of its support, there occurs more or less descent of the bowel. This descent is augmented by an effort to defecate. The external sphincter fails to act properly because the descending fæcal matter is to a certain extent diverted from its course and consequently fails to exercise the proper dilating influence upon the external muscle. The treatment consists (1) in restoring the integrity of the parts upon the damage to which the rectal displacement depends, and (2) in restoring the rectum itself to its normal position. Reed has operated in these cases by means of the Emmet operation for deep lacerations of the perineum, supplemented by the following steps: An incision is made transversely midway between the anus and the tip of the coccyx, care being taken to avoid the external sphincter. This incision, which is about an inch and a half long, but which may be longer, if required, is carried down to the posterior wall of the rectum, which is then dissected up to a point beyond the levator ani. The sacculated bowel is then lifted above the levator to which it is attached by a few interrupted catgut sutures. The external incision is then closed. Harris's operation for deep injuries of the muscular floor of the pelvis may be substituted with advantage for the Emmet operation in these cases.

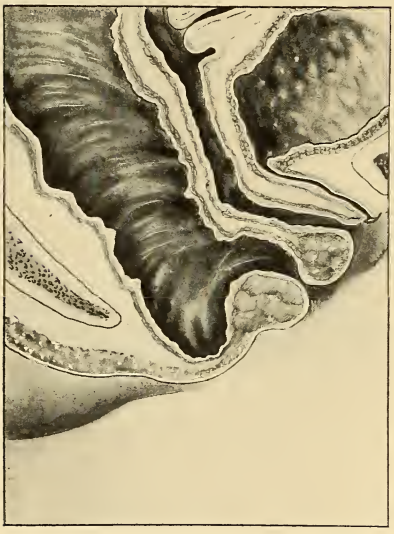

Fig. 337.—"Posterior rectocele."—Reed (page 817).

Prolapsus of the rectum may be either (1) partial, or (2) complete. By *partial prolapse* is implied merely a descent and extrusion from the anus of the mucous membrane of the rectum, and it is the condition generally designated prolapsus ani; complete laceration implies the descent and extrusion from the anus of the entire rectal walls, and is the condition ordinarily designated prolapsus recti. Partial prolapsus occurs, for the most part, in children, and is caused by efforts at defecation, either in constipation, or in diarrhœa associated with rectal irritation and consequent tenesmus. *Complete prolapse* occurs more frequently in adults and is the result of straining at stool, either from constipation, vesical tenesmus induced by stone in the

bladder or other causes, uterine displacements caused by polypi, etc. Injuries of the pelvic floor, relaxation of the muscular apparatus of the rectum, and general enteroptosis, are to be considered as predisposing causes. The *symptoms* of prolapsus of the rectum, whether complete or incomplete, consist in the sudden appearance of a mass just outside the anal orifice, which, upon examination, will be found to consist of folds of mucous membrane. If this extrusion is recent and the sphincteric contraction is not extreme, the mass may present a ruddy hue, but, if the case has been one of long standing, it may be dark in appearance, or even gangrenous. The diagnosis is self-evident, but is easily confirmed by introducing the anointed finger into the anus.

The *treatment* may be either (1) palliative or (2) radical. The *palliative* treatment consists in the immediate return of the parts. This is accomplished in children by placing the patient upon her side, anointing the fingers of one hand with some sterilized preparation, and then by gentle pressure replacing the extruded mucous membrane. An anal compress may be applied following the replacement of the bowel. In some cases, however, the extrusion may have existed for so long a time, and the sphincteric constriction may have been so extreme, that strangulation with death of the structures may have ensued. It is to be remembered that, both in complete and incomplete prolapse of the rectum, spontaneous amputation of the extruded part occasionally occurs, resulting in the cure of the patient. When the condition has gone to the stage that threatens this result, intervention because of its probable danger, is of questionable value. By the slow amputation of the extruded rectum, there occurs a fixation by inflammatory process of the remaining intra-anal segment; and it is obvious that, if this fixation is disturbed, there may occur a retraction of the upper portion of the rectum, resulting, in the event of cure, in the deposit of a zone of cicatricial tissue and the development, later, of intractable stricture. If, however, in the event of complete prolapsus, there is a reasonable prospect of saving the bowel, the patient should be placed in either the knee-chest or the semiprone posture, and the bowel should be replaced by digital manipulation. If this is not practicable because of intractable sphincteric spasm, an anæsthetic should be given to the patient. Divulsion of the sphincter, which would facilitate the reduction of the bowel, is not desirable, for the reason that the sphincter, in its full tone and integrity, is required to maintain the replaced bowel in position. For the purpose of restoring the normal contractility of the relaxed bowel, it has been recommended to cauterize it in spots with either the silver nitrate or the cautery. A rectal tube of soft rubber may be used to maintain the reduction. In exceedingly obstinate cases, a V-shaped piece has been removed from the sphincter, the apex of the letter pointing backward toward the coccyx, the sphincter being restored after reduction of the bowel. Jaennel, of Toulouse (*Bulletin de*

l'Académie de médecine), believes that rectal prolapse is due, in many cases, to a weakening of the ligaments that hold these parts in position, especially the mesocolon and the mesorectum, establishing the condition to which allusion has already been made as that of enteroptosis. He treats this condition by performing an ordinary colotomy. The sigmoid flexure is sought for, drawn upward, and fixed to the abdominal wall by sutures. The next step is to establish an artificial anus, which will afford the necessary rest until firm adhesion has occurred. The opening is not closed until the flexure has become firmly adherent. The operation has been performed with entire success in one case, the patient being cured in two months. It was performed in three sittings and this is one of its disadvantages; besides, it is not easy to find the sigmoid flexure. It has the advantage over other operations for rectal prolapse, however, in that it removes the cause of the trouble and is less dangerous. It is contraindicated in recent cases of medium severity or in old cases in which the prolapse is due to inflammatory peritoneal adhesions.

General Etiology of Rectal Disease.—Because of its peculiar function, the rectum frequently becomes diseased. There are so many factors entering into the etiology of rectal disease that we shall not attempt to mention them all. There is little doubt that the upright position assumed by man is a predisposing cause of hemorrhoids, because a large amount of blood is thereby thrown upon the valveless veins of the rectum. The most common of all causes, is *constipation* induced by irregularities in sleeping, eating, exercising, and attending to the calls of Nature. *Fissure* is usually the result of constipation in consequence of a tear made in the mucous membrane during the passage of hardened fæces; *ulceration*, because of pressure of the fæcal mass on the blood vessels causing necrosis; *hemorrhoids* ensue because of pressure interfering with the return flow of blood and, further, as a result of straining coincident with their expulsion; *prolapsus* and *invagination* are of frequent occurrence in the constipated on account of straining and the dragging down of the bowel by the fæces. The mucous membrane of the rectum is very fragile and is occasionally injured sufficiently by the fæcal concretions to set up a *proctitis* which may confine itself to the rectum or extend into the circumrectal tissue causing *ischiorectal abscess* and *fistula*. *Neuralgia* of the rectum is now and then a symptom of costiveness and results from the nerves being caught between bony structures on the one hand, and a fæcal mass on the other.

Strong drink and other forms of *dissipation* are responsible for many of the ailments in this locality. Persons suffering from pruritus and hemorrhoids are invariably worse after a spree. The continued use of purgatives is a common cause of rectal disease, owing to the straining and irritation of the mucous membrane induced by them. *Chronic diarrhœa* may incite a prolapsus, ulceration, or hemorrhoids, on account of the frequent stools, tenesmus, and passage over the

sensitive membrane of irritating discharges. *Threadworms, pediculi,* and anal *eczema,* not infrequently start an itching about the anus which is difficult to arrest. Constipation, stricture, and fissure, in young children can usually be traced to a *congenitally narrow* anus.

Foreign bodies reaching the rectum by way of the mouth or anus cause considerable suffering and may require an operation to remove them. *Traumatism* caused by hardened fæces or operation is responsible for many of the afflictions in the terminal colon. The Whitehead operation, when primary union is not obtained, results in many unpleasant sequelæ such as ulceration, stricture, fistula, abscess, pruritus, and incontinence; other operations may do the same, but only at rare intervals. Many injuries of the rectum follow the frequent and careless introduction of the syringe nozzle by the person in the habit of taking enemata.

Occupation is an important factor in the causation of rectal disease. Persons whose employment requires a sedentary life, their being constantly on their feet, or irregular hours for eating and attending to Nature's demands, are frequent sufferers from hemorrhoids and fissures. The upright position assumed by conductors, brakemen, engineers, and motormen, combined with the irregular jarring motion of trains and street cars, is a predisposing cause of rectal disease. On account of the vascular arrangement, obstructive diseases of the *liver* and *heart* are usually accompanied by hemorrhoids. *Tumours* in, or *displacements* of, neighbouring organs, as an enlarged prostate or a retroverted uterus, are the cause of many patients going to the proctologist. The function of the rectum renders it liable to injury, thus preparing the way for infection, local and general, by the various micro-organisms contained within its walls. Venereal diseases common in the sexual organs are found also in the rectum and about the anus of those who practise *pæderasty* (rectal intercourse), but with less frequency. Pæderasts are recognised by their relaxed sphincters and the funnel shape of the anus. The large rectal veins in passing from without the bowel to the mucous membrane within, go through muscular buttonholes. It is believed by some that frequent muscular contraction around the veins results in their enlargement below, terminating in piles. Occasionally the levator ani and external sphincter become hypertrophied and irritable as the result of a fæcal mass pounding upon them, and thus interfere with defecation or cause much pain by their frequent contractions. Undue force exhibited by the abdominal muscles will produce an engorgement of the rectal veins; this can be demonstrated by having a patient suffering with hemorrhoids strain down, when they will immediately enlarge and turn blue. Houston's folds sometimes become hypertrophied, resulting in constipation and allied ailments.

The Relation of Intrapelvic Disease to Disease of the Rectum in Women.—Intrapelvic disease in women may disorganize the function or compromise the integrity of the rectum. Such results are the

product of (1) *pressure* upon the rectum by means of a displaced uterus or ovary, or of a tumour or adventitious peritoneal band; (2) the extension of an *inflammation*; (3) *adhesion* of a viscus to the rectum or sigmoid flexure, or of adhesion of one part of the gut to another.

Pressure on the normal rectum of a retroposited but nonadherent uterus will not often obstruct the descent of the fæces provided urination precedes the attempt at defecation. An ovary prolapsed into the cul-de-sac will interfere with defecation, inasmuch as its sensitiveness to pressure arrests the voluntary effort of the patient. An intrapelvic tumour, nonadherent to the rectum, obstructs defecation in proportion as it limits the dilatation of the rectum; the same may be said of an adventitious band of peritoneum about the rectum. The presence of any of these conditions may interfere with the nutrition of the rectum or obstruct its circulation and provoke proctitis, ulceration, and hemorrhoids, and render the rectum prone to other diseases.

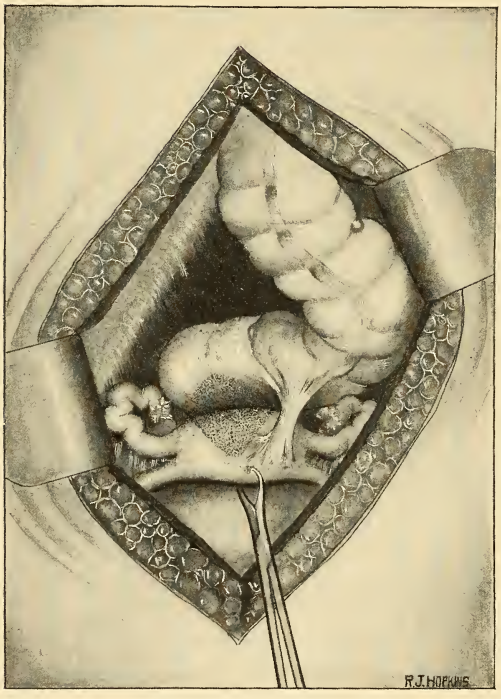

Fig. 338.—"Adhesions to the rectum, and particularly to the sigmoid flexure, may arrest the descent of fæces." (The dotted portion shows an adhesion which has been broken up.)—Martin (page 823).

Inflammation of any pelvic viscus, pelvic peritonitis, appendicitis, or pelvic cellulitis, by reason of the usually concomitant proctitis and infiltration of the rectal valves, produces a transitory diarrhœa, constipation, or obstipation; if resolution is imperfect, the obstipation will become chronic—in such a condition there is always a remote possibility of acute and complete obstruction from inflammation and œdema of the affected rectal valve. Intrapelvic abscess finds its quickest avenue of escape into the rectum. This event is characterized by amelioration of the patient's symptoms and subsequent purulent discharge from the rectum. Proctoscopy reveals a more or less general proctitis and, at the vicinity of the fistula, an œdema and corrugation of the mucous membrane; if the perforation is not at

once visible, pressure on the abdomen will cause pus to be ejected at its site.

Adhesions to the rectum, and particularly to the sigmoid flexure, may arrest the descent of solid or semisolid fæces without contracting the bowel's lumen; inasmuch as the immobilization of a portion of an organ which is essentially peristaltic, robs that portion involved, of its intrinsic power of propulsion of its contents (Fig. 338). Nonperistalsis of the rectum by reason of adhesion to a pelvic viscus is, however, but a minor factor in the resulting obstipation, because the expulsion of solid and semisolid fæces is in the main accomplished by the voluntary mechanism. In case of such adhesion, the adherent organ interferes with the necessary dilatation of the rectum, and, furthermore, the voluntary forces of defecation drive the adherent organ into the sacral hollow ahead of the fæcal mass.

Gant observes that disease occurring in either the genitalia or the rectum frequently manifests itself in the other organ because of the intimate relation of the veins, nerves, muscles, and lymphatics, supplying them. There are certain diseases that interfere with the circulation, and result in congestion or anæmia of the rectum, genitals, or both. Pain from disease in the vagina, uterus, ovaries, tubes or bladder, is frequently reflected to the rectum and *vice versa*. Fissure or ulceration of the rectum, exciting contraction of the external sphincter or levator ani muscles, causes similar contractions in the vagina and vulva. Pain following operations about the perineum and vagina is less when the sphincter is divulsed. Because of these frequent muscular contractions, the arrangements of veins in plexuses, and the intimate relation of the lymphatics, the exchange of infections from the genitals to the rectum, and *vice versa*, is quite frequent. Careful examination should be made both of the genitals and the rectum in all obscure diseases affecting either.

CHAPTER LI

INFECTIONS OF THE RECTUM

Inflammation—Periproctitis; Ischiorectal abscess—Gonorrhœa—Syphilis—Tuberculosis—Surgical conditions resulting from infections—Anal ulcer or fissure—Ulceration of the rectum—Fistula—Stricture.

Infections of the rectum may be classified as (*a*) mixed, and (*b*) specific. Mixed infections, i.e., those in which the various pus-formers—e. g., *Staphylococcus pyogenes aureus*, the various streptococci, and occasionally the migrated *Bacillus coli communis*—are found, are those that are manifested in the superficial inflammations, both catarrhal and follicular, and in deeper-seated inflammations, as periproctitis and ischiorectal abscess. The specific infections which will be considered in this connection are, gonorrhœa, syphilis and tuberculosis.

Inflammation of the rectum and sigmoid is a common ailment, and one easily recognised and treated by means of the colon tube. Ordinarily, the inflammation is confined to the mucous membrane, but occasionally it extends through the muscular coats causing periproctitis, ischiorectal abscess, and fistula. It is frequently the result of a more serious disease; occasionally, it is due to diphtheria and a membrane forms; again, because of proximity of the vagina to the rectum, it is caused by gonorrhœal infection; while, in tropical countries, it is often the result of a dysentery. Usually the mucous membrane will be inflamed and dry—atrophic catarrh—or spongy and smeared over with an abundance of mucus—hypertrophic catarrh. It may be either acute or chronic. Children are subject to the acute, and old persons to the chronic form; the former because of diarrhœa, and the latter, as a consequence of loss of tonicity resulting in fæcal accumulations. It may be caused by exposure to cold, sitting on damp steps, or traumatism due to swallowing a hard indigestible substance or to an operation. Not infrequently, it is brought about as the result of an irritable discharge from a stricture, cancer, ulceration, polypus or diarrhœa. Again, it sometimes follows the administration of drugs such as large doses of mercury and arsenic and strong purgatives.

Symptoms.—The symptoms of inflammation of the rectum and sigmoid may be briefly summed up as follows—viz., severe tenesmus and sense of weight and fulness in the rectum; sensations of heat, fulness, and soreness on pressure; frequent discharges of mucus and,

occasionally, of pus; spasmodic and unsuccessful attempts to evacuate the bowel. When due to atrophy following catarrh, the skin and mucous membrane about the anus are dry, harsh, and full of cracks; when to hypertrophy associated with catarrh, there will be a constant moisture in this locality. There is often pruritus due to irritating substances getting into the cracks, and to irritation of the skin and membrane caused by the discharge. In the acute stage there is a desire to micturate often, and, occasionally, incontinence of urine. Because of straining and frequent stools, a prolapse of the mucous membrane is not uncommon. If the inflammation is complicated by ulceration, bleeding may be a symptom, or fæcal matter may get under the membrane and start an abscess resulting in fistula. In general, any symptom present in inflammation of any part of the intestine may be present here, such as radiating and reflected pains and slight elevation of the temperature.

Prognosis.—When taken in hand early, inflammation of the rectum and sigmoid is easy to control. An acute attack may last one, two, or three weeks, and the chronic form indefinitely, depending upon the cause and its removal. When it has not existed more than a few weeks, the most apparent change in the former, barring the congested appearance of the mucous membrane, is the oozing of blood from many points when the speculum or colon tube is introduced. In cases of long standing, the mucosa becomes thickened, indurated, and loses its sensibility in a measure, so that a considerable amount of fæces may collect in the sigmoid and upper rectum before a warning is given of an approaching stool. Inflammation, when allowed to run an uninterrupted course, usually results in ulceration and stricture.

Treatment.—Remove at the earliest opportunity the source of irritation. Discard harsh and indigestible foods for milk, soft-boiled eggs, soups, beef juice, and other nourishing fluid and semisolid foods. Insist upon the discontinuance of eatables fried in grease, and those that are highly seasoned, and at the same time stop all alcoholic drinks. These patients must have regular hours for eating, sleeping, exercising, and attending to the calls of Nature. Keep the stools soft with two ounces of Carabaña water taken before breakfast, and clear the bowel of offending scybala, by massage, high enemas, Epsom salts, Seidlitz powders or other mild laxatives, and, above all, discontinue irritating purgatives. Keep the patients in bed as much as their circumstances will permit. The medical treatment consists in applying soothing, antiseptic, and astringent solutions, emulsions and powders, directly to the affected part by means of the colon tube, applicator, atomizer, and insufflator. The remedies which give the most satisfactory results are the nitrate of silver, balsam of Peru, sulphate of zinc, lead, alum, argonin, and ichthyol, alone or in combination. Gant is partial to the fluid extract of krameria, half an ounce to two ounces of distilled water, thrown into the sigmoid or rectum and allowed to remain there as long as it can with comfort to the patient. In aggra-

vated cases, the krameria may be increased to an ounce and a half, and the water increased in proportion. The treatments should be given two or three times weekly. When the intestine is chafed and irritable and tends to bleed, Gant has the patients use, on the remaining days, enemata of an emulsion composed of olive oil, 2 ounces, and subnitrate of bismuth, half a drachm, or nitrate of silver 60 grains, to the pint. When the inflammation is caused by threadworms it can be quickly subdued by a few copious injections of salt or limewater; santonin may be administered if the case justifies it. When due to gonorrhœal virus, frequent irrigation of the bowel with hot water or bichloride, 1 to 6,000, as hot as it can be borne, will be followed by gratifying results. In a general way, the treatment consists in keeping the bowels open and correcting errors in diet, together with frequent hot and cold irrigations.

Periproctitis; Ischiorectal Abscess.—Frequently, an inflammation starting in the mucous membrane extends through the rectal wall into the loose tissues around it, causing a diffused or circumscribed periproctitis resulting in ischiorectal abscess. Gant is of the opinion that this condition is made possible through the intestinal bacteria (probably the colon bacillus) having pyogenic properties, escaping into the blood vessels or lymphatics as a result of erosion of the mucous membrane. Another evidence of this is the fact that the pus from nearly all, if not all, ischiorectal abscesses contains the colon bacillus in large numbers. In addition to the symptoms of a simple inflammation of the rectum, we now have those of a constitutional character, as a chill, high temperature, quick pulse, restlessness, and in fact all the phenomena of pus formation. Circumrectal inflammation may be caused by an operation with resulting infection, or by the breaking down of tuberculous deposits.

Treatment.—Powell claims to abort ischiorectal abscess by deep injections of carbolic acid. Gant has not tried this plan, but has been in the habit of using the ordinary palliative measures until there is evidence of pus formation. He then opens the abscess by a free incision, breaks up all pockets with the finger, curettes out all gangrenous tissues, and then swabs out the cavity with carbolic acid and packs it with sterile gauze. The dressings are removed whenever they are soiled; the wound is then irrigated and repacked loosely with gauze. Many physicians make the mistake of putting the dressings in too tightly, thereby arresting granulation. Patients should be told that they have a serious trouble which may result in fistula and a second operation, though this is rarely necessary when the abscess has been treated properly, and by that is meant radically.

Gonorrhœa of the rectum is of occasional occurrence in America, but more frequent in England, and particularly in France. It is caused by infection of the rectum with the gonococcus of Neisser, although, as ordinarily found, it is here, as elsewhere, a mixed infection. It is generally caused by an associated attack of gonorrhœa infecting pri-

marily the genito-urinary apparatus. The discharge, which is generally copious in the acute stages, may bathe the perineum or invade the anal folds, from which it gains ready access to the mucous surfaces above the anal constriction. In other instances, and, perhaps, in the majority of all instances, the infection occurs as the result of using for the purpose of a rectal injection a syringe nozzle which has been employed in an infected vagina. The disease may result from perverted sexual indulgences.

The *pathology* is essentially that of an acute inflammation depending for its occurrence, primarily, upon the specific coccus of Neisser. The action of this micro-organism is very virulent and results speedily in the destruction of at least limited areas of rectal epithelium, resulting in the development of granular patches which are ordinarily designated ulcerations. The mucous follicles are invaded, resulting in their stimulation to catarrhal activity. If the epithelium of the efferent ducts is destroyed, they may become occluded, resulting in the development of retention cysts. The majority of the follicles, however, undergo hypertrophy and become more or less persistently catarrhal. In the presence of an infection atrium, the micro-organisms penetrate the deeper structures and may cause ischiorectal abscesses; or they may invade the lymph spaces causing enlargement of the pelvic lymphatics, or even resulting in some cases in suppuration. The infection may, by traversing the lymph channels, reach the peritoneum, causing septic inflammation of that membrane. When the inflammation has been so intense as to cause extensive epithelial destruction, post-inflammatory contractions resulting in stricture may supervene.

The *symptoms* of gonorrhœa of the rectum consist in pain associated with burning and tenesmus in the earlier acute stages; there is also a copious muco-purulent secretion which is discharged at frequent intervals. The diagnosis depends upon the demonstration by means of the microscope of the gonococcus of Neisser.

Treatment must be based upon the facts that the infection is a virulent one and that the surface of the rectum is very absorbent. Antiseptic agents, such as carbolic acid or the mercuric bichloride, are not eligible, while nitrate of silver is so destructive and so painful that it ought not to be employed. Strong injections of saturated solutions of boric acid, however, are well borne, and have pronounced antiseptic properties; to secure their best effects, however, they should be preceded by copious injections of a detergent saline solution, such as the bicarbonate of sodium. If the injections are given cool, they will be better borne and have a soothing effect upon the inflamed rectum. It is well, in some cases, to begin the treatment by means of a saline cathartic, as the fæcal current induced by that means will wash out much of the infection; and, besides, the *Bacilli coli communes*, which are brought down in large numbers, have a bactericidal action upon the gonococci. Topical treatment should be continued until the gonococci can no longer be demonstrated in the rectal secretions.

Syphilis of the Rectum.—Syphilis of the rectum is of frequent occurrence, and may manifest itself at any stage and in a variety of forms. It is more common in women than men because of the proximity of the anus and vulva. The inoculation of the rectum may be the result of syphilitic discharges coming from the vagina dribbling over the anus; again it may be brought about by a chancre on the penis coming in contact with the anal aperture during sexual intercourse, and occasionally through unnatural copulation (pæderasty). Chancroids will be considered along with syphilis because it is often difficult to distinguish between the hard and soft sores, and, further, because the local treatment of these two affections is identical. Syphilis may reveal itself at the intestinal extremity in the congenital variety or in the form of a chancre, chancroid, mucous patch, condylomata or gummatous deposit.

In *congenital* syphilis of the rectum, the anus and vulva will be disfigured by multiple mucous patches and irritating fissures, which cause the child much pain when a hard stool is passed. Such children have notched teeth and the usual characteristic markings of inherited syphilis.

True chancre of the rectum is uncommon, but, when present, its appearance does not differ greatly from that of chancre elsewhere. There is but one ulcer, surrounded by a hard, raised, inflammatory band, which is not very sensitive to the touch, and does not give much pain unless irritated. It is sometimes quite difficult to distinguish between it and a chronic fissure or ulcer, and for that reason we should not be hasty in making our diagnosis, but should wait for the eruption which will certainly settle the question.

Chancroids at the anal margin are quite common, especially in prostitutes, but cause more suffering than when located on the penis or vulva, which fact is attributable to the irritation caused by the passing over them of the fæces. They are usually multiple, superficial, and have sharply defined edges, are sensitive to the touch, and give off a discharge which irritates the skin, causing a pruritus that is difficult to relieve. Now and then they extend up the rectum and, when healed, a sufficient amount of contraction follows to produce a stricture. They are occasionally seen to become phagedenic and rapidly eat their way into adjoining structures, entirely destroying the external sphincter in less than a week's time.

Mucous patches are disposed to form at the anal margin during the second stage of syphilis. They are moist, slightly elevated, and give off a foul odour, are grayish in colour, and are found more frequently in this locality than, perhaps, any other manifestation of this disease. When the parts are not kept clean, they multiply swiftly and coalesce, forming thick warty masses, called *condylomata* (Fig. 339), and are covered with an offensive discharge that soon inoculates the neighbouring skin and membrane; in fact, if allowed to run an uninterrupted course, they may attain enormous proportions. At times, these masses

will be separated by deep fissures, in other cases they degenerate into a low form of ulceration.

Gummata are not seen especially frequently, even by those physicians who do a large practice in rectal surgery; at the same time they are to be found in the rectum more often than is generally believed by the profession, and with greater frequency in this locality than elsewhere in the intestine. When detected early in their formation, they give to the finger a sensation similar to that of an abscess before fluctuation is present; in other words, they feel like thick, flat, indurated masses in the rectal wall. After they break down, the rectum feels ragged to the touch because of the nodules and intervening ulceration. As a rule, healing occurs as the mass gives way, and the ulceration extends until sufficient contractile tissue is formed to make a tight stricture. Gummata are rarely numerous and large enough to obstruct the calibre of the bowel to any serious extent. Neither do they cause a great deal of pain by pressure upon the nerves. On the other hand, when a stricture has followed their breaking down, the suffering of such patients is pitiable to behold, they spend most of their time in the closet without relief, have local and reflected pains, itching about the anus, pass large quantities of pus, blood, and mucus, and frequently suffer from abscess, fistula, and, occasionally, incontinence.

Fig. 339.—"They multiply swiftly and coalesce, forming thick warty masses."—Gant (page 828).

Treatment.—Infants suffering from *congenital* syphilis must be put through a course of treatment early in their career, if we would rid them of this terrible inheritance. The treatment should not be confined to the child alone, the mother should be given the usual antisyphilitic remedies during the nursing period. She should take ten grains of the iodide of potassium three times daily, a short time before the baby is permitted to be nursed. In addition, if she is run down, tonics should be given to build her up. The child should be given small doses of mercury, preferably in the form of an ointment rubbed

in over the abdomen or soles of the feet. For the local manifestations about the anus, cleanliness is the principal thing. To encourage healing, solutions of alum, zinc, lead, or the bichloride of mercury, or powders such as calomel, iodoform, orthoform, subiodide of bismuth, or tannic acid, judiciously applied, will render efficient service.

In *chancres and chancroids*, persons suffering from the former should be put through the ordinary antisyphilitic treatment. The local treatment for the soft and hard sores is practically the same. They should be cleansed several times a day with antiseptic and stimulating solutions, and covered with a reliable ointment or powder known to have healing powers. Sometimes it becomes necessary to make strong applications to them of the nitrate of silver, carbolic or nitric acid, or perhaps the actual cautery; the latter is especially valuable where they take on a phagedenic character.

When they are seen in the early stage, *mucous patches* require the same treatment as the chancre; but later on, when they have proliferated and formed numerous *condylomatous* masses upon both the skin and mucous membrane, they require radical measures. Gant excises them with the scissors and thoroughly cauterizes their base with the Pacquelin cautery, and then treats them in the same manner as traumatic ulceration. They are so persistent that even this operation may have to be repeated.

Gummata require both constitutional and local treatment. The iodide of potassium in large doses seems to prevent the formation of new deposits and to hasten the absorption of those present, when accompanied by massage of the rectum by means of the Wales rectal bougie. Stricture following their breaking down should be treated as a stricture from other causes similarly located (see Stricture of the Rectum).

Tuberculosis of the Rectum.—The rectum, like other organs of the body, is occasionally the seat of tuberculosis; here, however, suffering is greater and healing more difficult to obtain because of the function of this organ. It is interesting to note the proportion of persons suffering from phthisis who are subjects of anal fistula and the number of the latter who are phthisical. Probably "from 4 to 6 per cent of all phthisical patients have fistula, while a much larger percentage of those afflicted with fistula have phthisis—12 to 15 per cent." Koch holds that tuberculosis of the intestine may be primary, or secondary to pulmonary involvement. The bacilli may be introduced in food, especially milk, or through the swallowing of sputum coming from a tuberculous lung. In perfect health, tubercle bacilli are destroyed by the gastric juice, but in cases of phthisis where there is a lowered vitality and a weakened gastric fluid, it is believed that they pass through the stomach into the intestine without losing their activity. Earle maintains "that the tuberculous process in mucous membranes, as well as in the lungs, can advance independently of the formation of miliary tubercles." He also reports 3 cases of primary tuberculosis, all

in negroes. He says, " What was particularly striking, was the apparent acuteness of the process; the mucous membrane between the points of ulceration was swollen and injected; in some cases covered with a slight fibrinous exudation. The ulcers appeared to result from the simple breaking down of this swollen and injected mucous membrane." Gant has never observed the condition just described. On the contrary he has often seen tuberculous ulceration of the rectum where the mucous membrane was thin, pale, and covered with a thin rice-coloured discharge.

Tuberculosis manifests itself in and near the rectum in three different forms, viz., ulceration, stricture, and fistula.

Ulceration.—From a clinical standpoint there are two kinds of tuberculous ulceration about the rectum, neither of which is of common occurrence, but both are difficult to cure. One is a real tuberculosis and can be demonstrated by the presence of the little tubercles and the bacilli. The second is a simple ulceration, from whatever cause, which is persistent owing to the debilitated condition of the patient caused by tuberculosis in the lung.

In many cases of tuberculosis of the rectum, the disease is not confined to this organ, but distributes itself along the entire intestinal tract, and the breaking down of the deposit in one locality is followed shortly by a similar process in other parts, until the field of ulceration covers a considerable portion of the gut. In such cases, the prognosis is bad; on the other hand, when the disease is located in the anal region, we stand a fair chance of effecting a radical cure, if we resort to heroic measures.

Tuberculous stricture is a rare disease in the rectum because the tendency of ulceration is to extend rather than to heal and form contractile tissue. Gant has observed in young women 2 cases of tight stricture undoubtedly of tuberculous origin. There are also two kinds of tuberculous *fistulæ,* the one the result of tuberculous infection, and the other due to ordinary causes, but made more difficult to combat because of the run-down condition of the patient, occasioned by tuberculosis in other organs.

Symptoms.—The general appearance of patients suffering from the different forms of tuberculosis of the rectum is about the same. They are usually much debilitated, have a sallow complexion, pinched face, sunken cheeks, prominent ears, clubbed nails, absence of fat in the ischiorectal fossa, and patulous anus surrounded by abundant long silky hairs. Many have an ugly cough and occasional hemorrhages, and are bothered with annoying night sweats. An ulceration, fistula, or stricture of tuberculous origin, bleeds less and is freer from pain than a similar condition from other causes. The mucous membrane is pale and thin, and the discharge from the diseased area is profuse, watery, and rice-coloured. Fistulous openings, instead of being small as in the ordinary fistula, are large, irregular in shape, bluish around the edges, and droop into the opening because of the undermined skin.

A probe can be inserted along the sinus without pain or difficulty. Those accustomed to treating rectal diseases have little trouble in distinguishing between the ordinary and the tuberculous types of fistula.

Treatment.—In spite of our best efforts, a good percentage of persons afflicted with tuberculosis of the rectum will die in from six months to three years. The results of treatment are not so good in this locality, because the disease is being constantly aggravated by the passage over it of fæces. The most essential thing in the treatment is to see that these sufferers get a reasonable amount of exercise in the sunshine, and are not confined in bed in a dark room. In fact, we should make everything about them as cheerful as possible. Every means should be resorted to, to build them up; generally, for this purpose, there is nothing better than plenty of nourishing food, stimulants, and tonics, such as creosote, guaiacol, cod-liver oil, malt extracts, iron occasionally, and, in fact, any tissue builder. If they can afford it, nothing will do them more good than a trip to the seaside or a change of altitude. Intestinal antiseptics should be given, as they sometimes benefit these patients very much; at other times, however, they are worthless. Ulceration rarely yields to palliative treatment, though we have to rely on it now and then when operation is refused. The ulcers should be cleansed frequently, after which some stimulating or antiseptic solution or powder should be applied. If they have a tendency to spread, a thorough burning with nitric or carbolic acid becomes necessary. When the treatment of tuberculosis is left entirely in Gant's hands, he treats it as though it was malignant. He curettes and trims the edges of the ulcers; after this, the affected area is thoroughly cauterized with a Pacquelin cautery. The post-operative treatment is the same as for a granulating wound of the rectum from other causes. Tuberculous fistulæ should be laid open and all diseased tissue removed, and should then be cauterized as though it were an ulceration. Care should be used not to sever the sphincter more than once, for incontinence occasionally follows the operation. If it is thought best not to give a general anæsthetic, to lose much blood, or to put the patient to bed, a ligature may be passed through the sinus and brought out at the anus, where it is tied and allowed to cut its way out. A cure will sometimes follow this method. Tuberculous stricture requires practically the same treatment as a constriction in the rectum from other causes. In the majority of cases, however, nothing short of colostomy and the prevention of fæcal irritation will do any good. After this operation a radical improvement will follow.

Surgical conditions resulting from infections of the rectum are various. Those which will be considered in this connection are (*a*) anal ulcer or fissure; (*b*) ulceration of the rectum; (*c*) fistula; (*d*) stricture.

Anal Ulcer or Fissure.—*Salient Symptoms.*—Often, there is itching at the anus. Pain on defecation or immediately thereafter is charac-

teristic. Intolerably painful anal spasm is often present. This disease sometimes affords a multiplicity of reflected symptoms.

Diagnosis.—Anoscopy reveals a narrow gray or red erosion or ulceration lying between the pilasters. Careful and systematic digital eversion of the anal folds, at the time when the patient bears down, may disclose the lesion. When the point of the probe comes in contact with the fissure, the patient usually signifies that the lesion is discovered. Fissures are most commonly situated posteriorly but may be situated at any point in the anal circumference.

A hypertrophied bit of tissue of a pale gray colour, and of about the size of a pin head, is often noticeable at the lower end of the fissure; this is the thickened wall of the anal pocket, to which Ball has given the name of sentinel pile.

Treatment.—The ulcer, if superficial, is to be touched with caustic or the electric cautery. This treatment is to be repeated after intervals of several days. It may be alternated with, or replaced by, the application of ointment, stimulating or sedative according to the requirements of the ulcer. A convenient method of applying the ointment is shown in the obturator-applicator (Fig. 327).

This may be done by placing the ointment in the cup, as shown in the illustration, lubricating the distal end of the instrument with the ointment, and introducing the anoscope to the necessary depth. This manœuvre places the ointment at a point opposite the diseased area where the obturator is to be steadied while the anoscope is drawn off it. The anus clasps the applicator around the anointed neck. Gentle rotation and withdrawal of the instrument expands the anus and exposes the otherwise infolded and concealed diseased area, and rubs into its surface the medicament which the grasping anus completely strips from the obturator. Application of nitrate of silver solution is efficacious.

The simplest and most efficacious treatment in that form of fissure that undermines the integument at its inferior end, consists in splitting the pocket by means of a small scalpel under infiltration anæsthesia by means of eucaine or nirvanine solution. The hypertrophied tissue should be trimmed away. The ulcer should then be touched with a solution of nitrate of silver, 40 grains to the ounce, and an opium suppository introduced. The anus should be subsequently dilated twice daily and the wound kept open till perfectly healed. Semidaily immersion of the hips in hot water should be practised. The conventional operation for fissure which requires general anæsthesia, divulsion of the sphincters, and their division by incision, is haphazard surgery and not uniformly curative, mutilates an important organ, is hazardous to its functions, and, in a measure, dangerous to the life of the patient.

Ulceration of the Rectum.—*Salient Symptoms.*—There is usually steady aching or sensation of heat and weight in the sacral region and lumbar spine; the disease is initiated with a short period of obsti-

pation or constipation, sometimes followed by a somewhat longer period of diarrhœa; finally, there are discharges of mucus. The fæces are sometimes streaked with mucus, with patches of membrane, and with specks of blood, and there is always more or less purulent material discernible. Pain and soreness are not uniformly present when the disease is situated high up in the rectum, but are invariably present when it is situated near or at the anus.

Diagnosis.—Proctoscopy reveals the fact that the mucous membrane lining the rectal chambers is deeply injected. The arborescent arterioles may appear in clusters of bright red twigs. The club-shaped venous radicles, which are of a purple colour, may be observed somewhat elevated above the surface of the mucous membrane at various points throughout the chambers, and there is a generally diffused redness throughout the entire area involved. Extensive proctitis sometimes prevents inflation of the rectum. This may be overcome by spraying the rectum with a 4-per-cent solution of cocaine, which causes an ischæmia, thins the wall of the organ, and renders it inflatable or dilatable by the use of the coactor. The ulceration is characterized by the destruction of a circumscribed area of epithelium occupied by reddish granulation tissue; the surface is often seen coated with inspissated muco-pus. Ulceration may be accompanied by a more or less diffused chronic proctitis with general superficial erosion of the mucous membrane. Venereal ulcers present their typical features when situated in this organ. Tuberculous ulceration presents a clearly defined border and is usually surrounded by a pale blue mucous membrane. Microscopic examination of scrapings positively determines its character.

Treatment.—Inflammation and ulcerations of the rectal mucous membrane may be rapidly cured by spraying the part with silver-nitrate solutions of 3 or 4 grains to the ounce. With the patient under proctoscopic examination, the operator should take the proctoscope in his left hand, and in his right, the anal atomizer which should be attached to a compressed-air reservoir. By co-ordinate movement of the hands, each of the chambers involved in the disease may be rapidly and systematically sprayed with the solution (Fig. 340). If the hand-bulb spray is used, an assistant will be required to hold and direct the proctoscope from chamber to chamber.

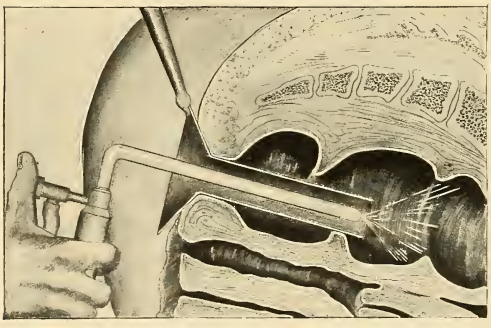

Fig. 340.—"Each of the chambers involved in the disease may be rapidly and systematically sprayed."—Martin.

Because of the humidity of the rectum, the actual cautery should not be introduced into it as the consequent rapid evaporation occasions intense pain. Chancroid ulcers should be coated once with the charcoal-and-sulphuric-acid paste. Enemas of bovinine prove decidedly reparative. Rectal lavage should be employed daily.

Fistula.—*Salient Symptoms.*—Muco-purulent discharges from the rectum, or sero-purulent discharges from an opening in the adjacent anal surface, are the common manifestations of this disease.

Diagnosis.—With the patient in the Sims posture, manual eversion of the buttocks should be practised while the patient is required to bear down. At this moment, ocular inspection of the field should be made. Crypts, lacunæ, or other depressions of the surface, should be critically examined with the point of the probe. Should the probe enter, the patient should be required to relax the parts, and a tentative search should be made for the internal orifice of the fistula. The probe should be steadied and the patient put into Martin's posture, which usually smooths out the intra-anal folds of membrane, and the anoscope introduced, and, by means of another probe, inspection should then be made of the mucous surface of the anus to determine if there is an internal orifice. The internal orifice of a fistula discharging internally is usually marked by small granulations or vegetations. The search may be made more thorough if a small applicator is employed to smooth out intra-anal folds of mucous membrane. The sphincters should be cocainized and a fenestrated conoid speculum, such as Aloe's, inserted on its obturator, and the obturator or slide withdrawn. This instrument should be introduced with its fenestrum straddling the tissues penetrated by the first probe. Careful search for an internal orifice should be repeated. If none is discovered, the probe should be withdrawn and the cavity of the fistula injected, at its external orifice, with a sterile solution of milk or peroxide of hydrogen and the anoscopy repeated. If even this manipulation fails to discover an internal orifice, further search should be abandoned till the time of operation.

Treatment.—The probe should be introduced into the external orifice of the fistula, the conoid speculum reintroduced, and its fenestrum made to straddle the probe as already described. The tissue from the external orifice of the fistula to a point within the anus as high as the distal end of the probe, should be subjected to infiltration anæsthesia. The probe should be thrust onward through the mucous membrane and into the channel of the gut. An incision should be made through both mucous and cutaneous surfaces down to the probe. If, on the other hand, the fistula has an internal, but no external opening, the probe should be bent to form a long hook-end and should be carried through the anoscope or Aloe's speculum, and into the internal orifice. When it has been made to pass as deeply toward the cutaneous surface as possible, the anoscope should be withdrawn and an effort made to draw the probe-hook deeper through the relaxed

tissues and toward the skin. The probe should be steadily maintained in this position while the fenestrated conoid speculum is made to straddle it. Infiltration anæsthesia should be established, and an incision made in the manner already described. The wound should be antiseptically dressed and cared for. The more radical operation, consisting in dissecting out the sac and suturing together the freshened surfaces of the walls of the fistula, may be performed under local anæsthesia. This operation begins where the simpler procedure just described leaves off, inasmuch as that technique is necessary to expose the fibrous structure of the fistula wall. Bleeding vessels should be clamped and hot gauze pads applied to the wound till all hemorrhage is checked, for a bloodless field is necessary for infiltration anæsthesia. The hemorrhage stopped, the anæsthetic solution should be injected all about the fibrous tissue to be removed, the most accessible portions should be seized with a hemostat for convenience of manipulation, and a rapid dissection made. An assistant must follow each sweep of the knife with the hot gauze, for anæsthesia and a non-bleeding field go hand in hand. The fibrous tissue should not be removed piecemeal; the portion dissected loose may be used as a retractor to facilitate the dissection of that still attached. The parts, fascia, sphincter and other muscle, and integuments, should be re-anæsthetized and the wound closed by suture. Fistulæ located laterally and anteriorly to the anus, and having an external orifice, if the recto-vaginal septum is not divided, take a course forward into the labium majus, or backward toward the anterolateral anal quadrants, which they tend to enter between the sphincters. Fistulæ situated in the ischiorectal fossæ usually penetrate the rectum on the side of their origin and between the sphincters. If they enter the body farther, they generally take an outward direction beneath the levator ani or coccygeus muscle. External fistulæ are not often situated posteriorly. But, not infrequently, a complete internal fistula may be discovered by means of the diagnostic technique described, situated posteriorly, and having an inferior orifice at the border of the internal sphincter and a superior orifice posteriorly and above the coccygeo-levator ani. When the probe has entered an inch (2.54 centimetres) or more, a fenestrated curette should be introduced into the rectum to a point

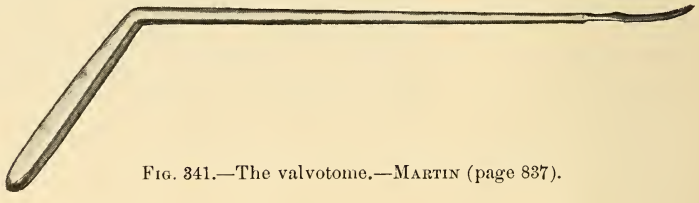

Fig. 341.—The valvotome.—Martin (page 837).

higher than the estimated site of the end of the probe, and an endeavour made to hang the curette thereon. If this succeeds, and the curette can not be directly withdrawn, the diagnosis of the complete

fistula just described is made. A grooved director should be substituted for the probe, a 3-inch needle fixed to the hypodermic syringe, and the tissue between the director and the rectal lumen infiltrated with the anæsthetic; then the special knife shown in Fig. 341 may be put into the director and made to cut through the ano-rectal wall. When this is accomplished, the director and curette may be withdrawn without removing the former from the fenestrum of the latter. The fibrous base of the fistula should now be curetted and subsequently packed. Daily anal dilatation should be enjoined till the wound heals. Simple external fistulæ of recent origin may be cured by curettage, by injection of stimulating fluids, and by vigilant general care.

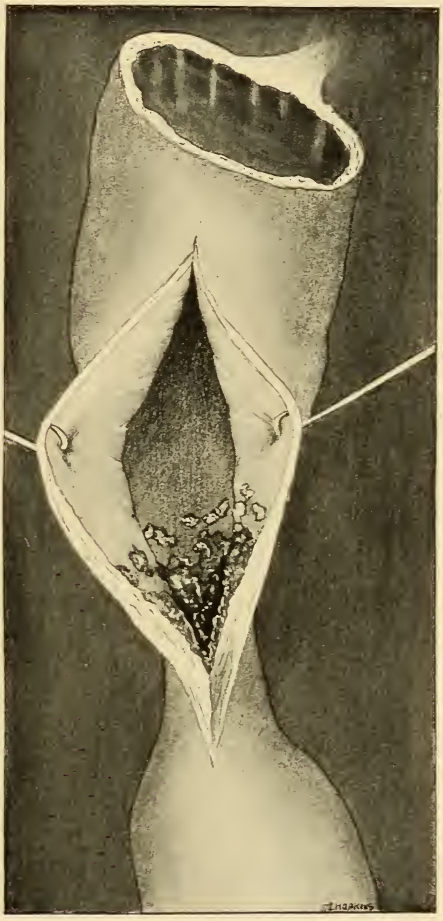

Fig. 342.—"Ulceration leaving thickened walls of contractile tissue."—Gant.

Abscesses and fistulæ in the pelvic floor about the anus, often present the most complex problems. Their perfect comprehension involves a study of the fasciæ of the pelvic floor.

Stricture of the rectum is a diminution of the calibre of the bowel from any cause. Usually it is the result of an ulceration leaving thickened walls of contractile tissue (Fig. 342). Tumours within or without the bowel are often responsible for this affection; again, it may be the result of an enlarged prostate, or of the pressing of the rectum back upon the bony structures by a retroverted uterus. In exceptional cases, it is due to fibrous bands extending from one side of the bowel to the other. From the standpoint of physical exploration, strictures may be divided into three classes: viz., (*a*) annular or narrow; (*b*) tubular or broad, and (*c*) nodular. In the first, only a small portion of the bowel is involved; in the second, the strictured area may occupy several inches; while in the third, the obstruction is the result of one or more nodular tumours projecting into the

calibre of the bowel at one or more points. Again, strictures are further divided, and are called *complete* when there is total obstruction, and *incomplete* when all or a part of the fæces escape through them. Congenital strictures will not be dealt with here. From a pathological standpoint, Gant classifies strictures of the rectum as follows:

(1) Traumatic; (2) syphilitic; (3) tuberculous; (4) catarrhal; (5) dysenteric; (6) malignant.

(1) *Traumatic.*—All agree that *traumatism* is a frequent cause of stricture of the rectum. It may be the result of any one of a number of operations performed about the rectum and anus for the relief of hemorrhoids, fissure, ulceration, fistula, prolapse, or cancer. It is sometimes caused by direct injury to the rectum as the result of an accident, or the swallowing of some hard substance, as a piece of bone or a pin, which lodges near the anus and keeps up a constant irritation. The most frequent cause of traumatic stricture is constipation and impaction. Chronic constipation, where the fæces are allowed to remain in the bowel for several days at a time, is a frequent cause of stricture. (2) *Syphilis* may be the cause of stricture of the rectum as a result of chancres or chancroidal ulceration in the initial stage, of gummatous deposits, or of extensive ulceration following the breaking down of such deposits, the latter being by far the more frequent cause. Syphilis probably causes as many strictures as all the other etiological factors put together. (3) *Tuberculosis* of the rectum seldom causes stricture, because, when the tubercles begin to give way, they can only exceptionally be successfully healed, in consequence of the absence of contractile tissue. Gant has seen cases of marked constriction, however, that could not be attributed to other causes. (4) *Chronic catarrhal inflammation* of the rectum may result in stricture as the result of occlusion brought about by the inflammatory thickening of the bowel, or from an ulceration started and maintained by the presence of large quantities of irritating mucus. (5) *Dysenteric stricture* is rarely seen in this section of the country, because here we have dysentery only in a mild form, but in tropical countries, where it is common in the severe form, it frequently results in a light stricture. (6) Stricture due to *cancer* is found as often in the rectum, as in all other parts of the intestines. It may be the result of one or more large hard masses obstructing the calibre of the bowel, or be due to cicatrization following ulcerations when they break down, or to both these causes.

The *symptoms* of stricture may be local or constitutional, dependent upon the condition at the time of observation; if extensive ulceration is present and the obstruction is complete, the usual symptoms of the accumulation of pus and obstruction will be present. The symptoms usually met with in a bad case of stricture are, constipation at the beginning; diarrhœa, intermitting with constipation; intense straining; a sensation as though the bowel never completely emptied itself; slight rise in temperature; occasional chill; indigestion; mild

peritonitis; tympanites; usually loss in weight; incontinence; discharges of pus, blood and mucus; pain in the rectum and distant parts; change in size and character of the fæces; numerous long slender skin tags, and partial or complete obstruction.

Diagnosis.—A large majority of rectal strictures are located in the lower 3 inches of the bowel and are easily recognised. When in the upper part, if they can not be located by the aid of bougies and the colon tube, an anæsthetic should be given, the abdomen opened, and the gut pulled up and examined.

Treatment.—The treatment is (*a*) palliative, and (*b*) operative. (*a*) *Palliative* measures for the relief of stricture consist in keeping the stricture open and hastening absorption; softening the fæces that they may pass through it; alleviating pain, and protecting the system against the absorption of poisons contained in the rectum because of the pus and retained fæces. Iodide of potassium in increasing doses and the massage of the stricture with the fingers or soft bougies, do a great deal of good in the earlier stages; but when the constriction is composed of contractile tissue the results are not so good. The diet should be restricted, so far as possible, to fluid and semi-solid foods, and to those which leave little residue. Pain is best alleviated by keeping the rectum clean with astringent, stimulating, or antiseptic solutions; when fæcal masses accumulate above the stricture, mild laxatives should be used, and high enemata of water, soapsuds, or oil and glycerine, but strong purgatives should never be given. In order that the patient may get some rest at night, opium, morphine, chloral, or the bromides, intelligently administered, will do as well as any other drugs; but they must be given with caution, for this affection is chronic, and many of these sufferers readily fall into the habit of taking them to ease their pain.

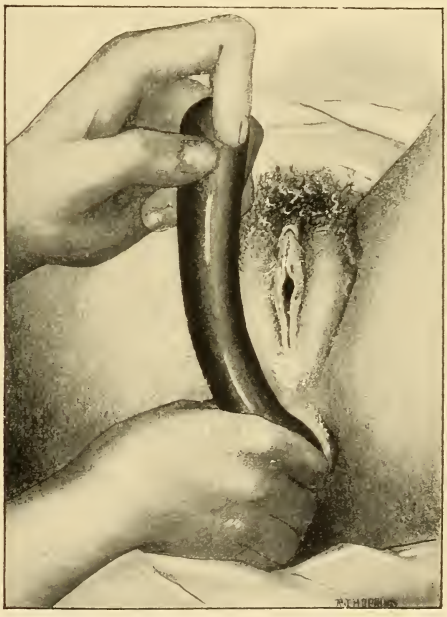

Fig. 343.—"The calibre of a stricture may be materially increased by means of gradual . . divulsion."—Gant (page 840).

(*b*) *Operative.*—In spite of the best palliative treatment, most strictures gradually progress until partial or complete obstruction is present, and it is necessary to resort to an operation to give them tempo-

rary or permanent relief. Enthusiasts in the use of electricity maintain, that, by this means, they can destroy the stricture or cause it to be absorbed. Gant, however, from what he has seen, is inclined to doubt the accuracy of this claim.

The following are the most favoured surgical procedures for the relief of stricture of the rectum, viz.: 1, dilatation; 2, internal proctotomy; 3, external proctotomy; 4, excision; 5, colostomy.

The calibre of a stricture may be materially increased by means of gradual (Fig. 343) or forcible divulsion. The first is accomplished gradually by the passage of graduated soft-rubber bougies; steel instruments should not be used because of the danger of rupturing the bowel. Bougies should be used two or three times each week until relief is obtained. If the patient will give her consent, forcible divulsion is preferable, because, under general anæsthesia, we can accomplish with the fingers in five minutes what would otherwise take weeks. Strictures of more than $3\frac{1}{2}$ inches should not be divulsed unless every precaution has been taken, for if the bowel is ruptured, the rectal contents are dumped into the peritoneal cavity and death will shortly result.

Internal proctotomy is done by guiding a blunt-pointed bistoury with the index finger until it is above the point of constriction, when the latter is severed at one or more points as the case demands. A piece of gauze is then placed in the incisions, to be changed from time to time, and the rectum cleansed as after any other wound in it.

External (*or complete*) *proctotomy* is performed by carrying the knife above the stricture, as in the internal method; it is then pointed backward until the bony structures are reached, when it is brought down and out, dividing the stricture and other tissues including both sphincters, thus leaving a long, deep, triangular cut. The advantages of this operation over the one just described, are several; it permits of free drainage, bleeding can easily be detected and arrested, it allows the free exit of accumulated fæces, and admits of medication, at all times, both below and above the strictured area. When a stricture involves only the superficial structures of the rectum, is freely movable, and is situated near the anus, *excision* is justifiable. When ulceration is extensive and obstruction is threatened, *colostomy* should be insisted upon, for it is the only thing that offers any permanent relief from the never-ending desire to stool. Frequently, after this operation, patients gain flesh and return to their work feeling like new beings. This operation is described in the chapter on Malignant Growths of the Rectum.

CHAPTER LII

NEOPLASMS OF THE RECTUM AND ANUS

Adenoma—Lipoma—Fibroma—Papilloma—Angeioma—Teratoma (dermoid cysts)—Retention cysts—Myoma and enchondroma—Malignant growths, symptoms, treatment—Operations: Divulsion; internal proctotomy; posterior proctotomy; curettage; colostomy; excision—Hemorrhoids, causes: External, symptoms, treatment: Internal, symptoms, treatment—Operations: Injection; Whitehead's; ligature; clamp and cautery.

The rectum and anus are the seat of new growths as frequently as other parts. Some writers labour under the mistaken idea that malignant tumours and simple polypi are about the only neoplasms to be found in this locality. Gant does not deny that they are of frequent occurrence, but there are a variety of other growths which manifest themselves in the rectum with varying frequency. Any of the following-named tumours are likely to be met with by physicians having a large rectal following: (1) adenoma (polypus); (2) lipoma; (3) fibroma; (4) papilloma; (5) angeioma; (6) teratoma (dermoid cysts); (7) retention cysts; (8) myoma; (9) enchondroma; (10) malignant growths; (11) varicose tumours (hemorrhoids).

Adenoma (Polypus).—Adenomata are found more frequently in the rectum than in any other part of the intestinal canal. In fact they occur there with greater regularity than almost any other tumour. Benign or simple adenomata are common in childhood, and comparatively rare in adults, unless preceded by some other disease with a coincident discharge. On the other hand, malignant adenomata usually attack those past middle life, and are rarely seen in children. All rectal tumours have a tendency to become pedunculated, because they are dragged down daily by the fæces. The word polypus is commonly applied to any growth in this locality having a narrow or pedunculated laminar attachment, with a large movable pendulous extremity. Van Buren once said that "in proportion as a tumour becomes pedunculated its danger of being malignant lessens." Gant's experience has been in accord with Van Buren's. Nevertheless, it is at times difficult to distinguish between the benign and malignant forms of adenoma. There are two kinds of polypi, the *adenoid*, or soft (Fig. 344), and the *fibrous*, or hard (Fig. 345). In rare instances, either of these growths may be found in great numbers scattered over the entire rectal mucosa; they are then distinguished as *disseminated* polypi.

Symptoms.—Polypi vary in size from that of a pea to that of an English walnut. The symptoms depend largely upon the size, location, number, and condition, of the tumours when seen. When situated high up in the rectum or sigmoid, they manifest their presence by irritating the mucous membrane, causing a sensation of uneasiness and the discharge of considerable mucus. Occasionally, they cause

Fig. 344.—"The adenoid or soft polypus."—Gant (page 841).

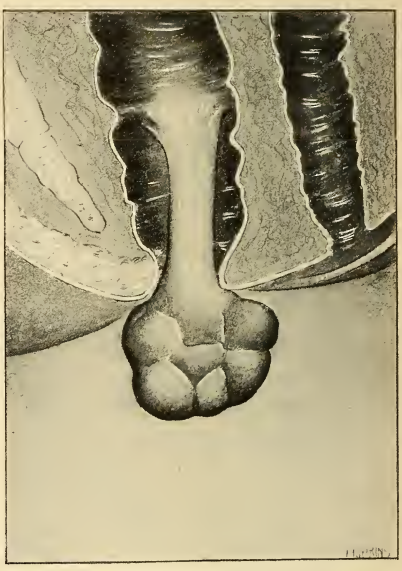

Fig. 345.—"The fibrous or hard polypus."—Gant (page 841).

invagination, tenesmus, and straining. If ulcerated, they bleed, and, when located near the anus, they protrude during stool. As a rule, they cause little pain unless strangulated.

Treatment.—Ordinary polypi are easily cured when within reach. They may be clamped with Gant's clamp, cut off, and the stump thoroughly cauterized with the Pacquelin cautery. When a cautery is not available, ligature and excision will prove quite as effective, but will cause more pain. When small, they may be seized with forceps and twisted off; when high up in the rectum, the snare is sometimes serviceable; Gant prefers in such cases to seize the growth with a long-handled clamp forceps and allow it to remain *in situ* until it comes off of its own accord. Medication in these cases will prove unsatisfactory. Once in a while polypi come away spontaneously or are detached by fæcal accumulations.

Lipoma.—Fatty tumours are occasionally met with in the anal region and do not differ in their construction from that of similar tumours in other localities. Gant has seen them both in the circumrectal tissues and under the skin at the anal margin. One tumour on the buttock at the verge of the anus was quite as large as a goose's egg.

Treatment.—The treatment consists in their enucleation and the closure of the wound with catgut.

Fibroma.—In rare instances fibromata develop about the anus and vulva, and in the rectal wall, without becoming pedunculated. They then present themselves in the form of hard, smooth tumours (Fig. 346). They resemble fibromata of the cutaneous surface in every way, except that they are covered by mucous membrane.

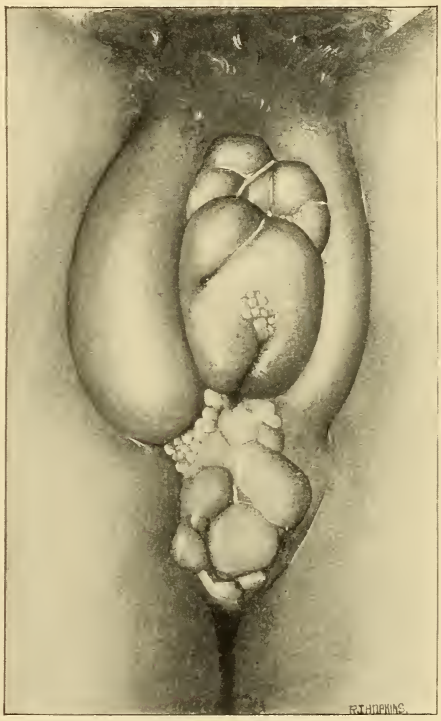

Fig. 346.—"In rare instances fibromata develop about the anus and vulva and in the rectal wall."—Gant.

Papilloma. — Papillomata are not uncommon in this region because of the irritation of the parts by the fæces and infectious discharges coming from the vagina. Senn has frequently seen the rectum studded with papillary tumours varying in size from that of a hemp-seed to that of a cherry. They are to be seen on the skin about the anus just about as frequently as upon the mucous membrane. As before intimated, they may be the result of a syphilitic, chancroidal, or gonorrhœal infection, or they may reveal themselves without any previous discoverable irritation. When located inside the rectum they are accompanied by occasional hemorrhages, the discharge of mucus, and tenesmus; when upon the skin, by smarting, soreness, and a foul odour when multiple and in clusters.

Treatment.—Palliative measures are now and then effective. These consist in cleanliness, cauterization with acids, carbolic and nitric, or the application of astringent powders, as tannic and gallic acid, alum, zinc, or calomel. The radical method of cutting them off with scissors and cauterizing the stumps with the actual cautery is the most satisfactory way of dealing with them.

Angeioma.—A few cases of angeioma (nævus) of the rectum have been recorded. Gant has never seen what he considers a typical case, though he has met with vascular growths which bled freely from various points. They were flat tumours, located about 2 inches above the anus.

Treatment.—They should be extirpated by ligation or cut away with scissors, the bleeding being arrested with the Pacquelin cautery.

Teratoma (Dermoid Cysts).—Dermoid cysts containing hair and sometimes teeth are not at all uncommon in the sacral region, and are frequently the exciting cause of fistula. Now and then they are found in the rectal wall and the hairs may be seen projecting into the rectum or out at the anus. They vary in size from that of a cherry to that of an apple. Their symptoms and management in this locality are the same as in other parts; the safest treatment is complete removal.

Retention Cysts.—Retention cysts filled with secretions and excretions, which may or may not have undergone degeneration, are at times found in and outside the rectum. They occasionally reach enormous proportions, Gant having removed one 8 inches in circumference. In one case, they may be filled with firm sebaceous material, in another, with a fairly thick whitish fluid. They cause no discomfort further than a fulness of the part affected.

Treatment.—The entire cyst wall should be carefully dissected out and the wound united with catgut, otherwise the cyst will refill.

Myoma and Enchondroma.—New growths composed of muscular and cartilaginous structures have been found in the rectum. The former is of more frequent occurrence than the latter, and is found in that situation with greater frequency than in other parts of the intestine. Nothing short of removal should be considered for their relief.

Malignant Growths.—There is still doubt as regards the true cause of malignant tumours. Statistics, however, show that they are on the increase in the rectum as well as in other organs. This does not apply to the negro race, as negroes are practically immune to this disease. Because of its function and make-up, the rectum is the seat of about 80 per cent of all morbid growths occurring in the intestines. Malignancy is common in middle life, less so in old age, and rarer still in childhood. The prognosis is, as a rule, bad, few living more than a year after the disease is recognised. In exceptional cases, however, patients may live two, three, and even four years. The younger the person, the sooner death will ensue. Malignant growths of the rectum develop principally from glandular tissue, and are grouped by Cripps (*Rectal Cancer*, third edition, p. 56) under the one head of adenocarcinoma. Sarcoma is extremely rare in this region, but Gant operated on a case of fibrosarcoma with multiple fistulæ involving the rectum and anus (Fig. 347). Carcinomata may manifest themselves as flat tumours in the rectal wall, may project into the lumen of the bowel, or circumscribe the lumen by a nodular band. Because of this difference in their clinical appearance, Cooper and Edwards (*Diseases of the Rectum and Anus*, p. 190) have described them as laminar, tuberous, and annular. Squamous-celled carcinoma (epithelioma) is occasionally met with at the mucocutaneous margin.

Symptoms.—In the earlier stages of rectal cancer, patients do not complain of acute pain, but of sensations of uneasiness, weight, and fulness in the bowel. When the tumour grows to considerable proportions and breaks down leaving a large ulcerated area, the following symptoms will be present:

(1) Irregular or constant pains in the rectum, neighbouring organs, and back of and down the limbs; (2) typical cachectic waxy complexion; (3) tape or ribbonlike stools; (4) prolonged straining and a never-ending desire to empty the bowel; (5) abundant discharges of blood, pus, and mucus; (6) loss of flesh; (7) because of increased peristalsis, food is rushed through the alimentary canal undigested; (8) constipation intermitting with diarrhœa; (9) low

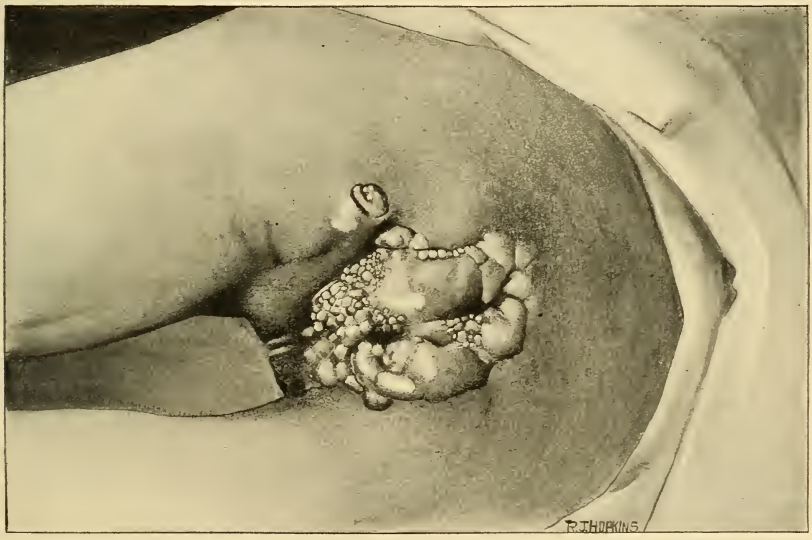

Fig. 347.—"A case of fibrosarcoma with multiple fistulæ involving the rectum and anus." —Gant (page 844).

form of peritonitis; (10) obstruction partial or complete; (11) when the growth is located at the verge of the anus, pain is much more severe owing to sphincteric contraction; (12) in the majority of cases there is partial or complete incontinence.

Treatment.—The treatment of malignant tumours of the rectum is unsatisfactory because most patients die in spite of anything that can be done. While Gant does not feel justified in stating that this disease is incurable, he does believe that total extirpation results more often in failure than its advocates would have the profession believe. Medication is useless beyond the relief it offers from pain, in the liquefaction of the fæces, and as a disinfectant in the various solutions used for irrigating purposes. The diet should be regulated and these sufferers should have plenty of sunshine and strengthening food.

Operations.—The following operations have been suggested for the relief of cancer of the rectum: (1) Divulsion, rapid, with the fingers, or gradual with bougies; (2) internal proctotomy; (3) posterior proctotomy; (4) curettage and cauterization; (5) colostomy (Allingham); (6) excision. The operations to be described should, with the exception of excision, be regarded as palliative measures only, and those who hope to make a radical cure with them will be disappointed.

Divulsion.—Sometimes there are patients suffering from new growths at the anus and low down in the rectum, who are threatened with obstruction, and are constantly annoyed by straining in their endeavour to relieve the bowel, who yet refuse to let the knife be used. In such cases, it is justifiable to resort to stretching the rectum, either with the fingers or bougies as may be deemed best (Fig. 341), and temporary relief will follow, because the fæces escape and the rectum can be irrigated.

Internal proctotomy consists in passing a probe-pointed bistoury beyond the point of constriction and incising the stricture or growth one, two, three, or as many times as becomes necessary, to relieve the obstruction. As a rule, the wound soon heals, contraction follows, and the operation requires to be repeated.

Posterior proctotomy is, next to colostomy, the best of all the palliative operative procedures. It is performed as follows: Protect the knife with the finger and pass it well above the obstruction, then directly backward to the bony structures, and thence downward, carrying it through the rectum and sphincters, until the cut is on a level with the tip of the coccyx, thus making a long deep triangular wound that gives plenty of room for the escape of accumulated fæces and at the same time permits free drainage, a great advantage over the internal method. Post-operative treatment consists in topical applications to the ulceration, and the occasional passage of a bougie to prevent rapid contraction.

Curettage.—Persons suffering from that form of malignant growth in which numerous cauliflowerlike masses project into the rectum, inducing pain and the frequent discharge of pus and blood, can frequently be relieved by scraping them down to a level with the rectal wall, and then burning the raw surface thoroughly with the actual cautery. The operation should be repeated as soon as the growth returns.

Colostomy is the most satisfactory measure we have for the relief of rectal cancer, and we do not except excision, taking one case with another. It diminishes the patient's suffering because it permits a free exit to the fæcal matter above the diseased part, thereby doing away with the diarrhœa and straining. It permits free irrigation of the rectum. Many patients soon regain the flesh they had lost and, in fact, feel like new beings; and they are not constantly annoyed by the escape of fæces through the artificial anus as some writers have stated. The lumbar opening has been discarded for the inguinal (Fig. 348),

principally because the patient can take care of herself after the latter. The most important point in the operation is to make a good spur, so that, when the gut external to the skin is removed, the ends of the

Fig. 348.—"The lumbar opening has been discarded for the inguinal."—Gant (page 846).

intestines will remain parallel, thus insuring that the fæces shall be deposited on the outside and not escape into the rectum as is the case when this precaution is not taken. A procidentia may ensue (Fig. 349) when the mesentery is too long, in which case several inches of the intestine should be cut off to prevent this accident.

Fig. 349.—"A procidentia may ensue."—Gant.

Excision.—Some writers affirm that by extirpation of the growth they can effect a permanent cure in a large percentage of their cases; such claims are just the opposite of the experience of those surgeons that confine their practice to diseases of the rectum. Gant does not say that life is not materially prolonged by this operation,

but he does believe, however, that the patients radically cured in this way are few indeed; it has been his experience that the growth soon returns. Excision is all right in properly selected cases, but, in most instances, the surgeon does not see the patients until the disease is far advanced. A growth situated near the anus can usually be removed by making a posterior incision as far back as the coccyx. After the coccyx is removed, sufficient room will be obtained to enable the operator to free the rectum from its attachments, this being best done with the finger or a pair of blunt scissors. The growth is then cut away, leaving the sphincter if possible, and the distal and proximal ends united; when there is too much tension, bleeding should be arrested and the bowel allowed to retract. If the peritoneum has been opened, it should be closed with catgut sutures or protected with sterile gauze and let alone. Bougies should be passed biweekly to prevent too much contraction. The high excision, or Kraska method, consists in removing a portion of the sacrum for additional room, and the suturing of the gut into the upper end of the wound when it can not be brought down and united to the severed gut below. The chief advantage claimed for this operation is that it gives sufficient room for the surgeon to remove the

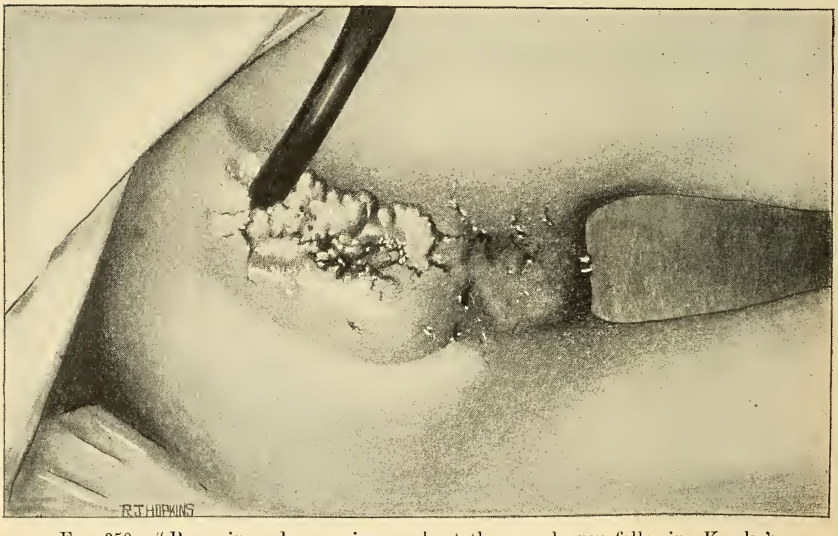

Fig. 350.—"Recurring adenocarcinoma about the sacral anus following Kraska's operation."—Gant.

entire growth. However, Gant had a case of recurring adenocarcinoma about the sacral anus following Kraska's operation (Fig. 350).

Hemorrhoids differ so widely in location, appearance, and make-up, that it is impossible to give a satisfactory definition of them. In a general way we might define them as being *vascular tumours of the mucous membrane of the rectum, the anus, or both.* They may be *external* or *internal*; the former are covered by integument, and the latter by

mucous membrane. Tumours covered in part by skin and in part by membrane are known as *combination* piles.

Causes.—The larger rectal veins pass through the rectal wall by means of little slits (Fig. 351). Verneuil believes the return flow of venous blood is impeded by the contraction of the muscular fibres around them, and, for this reason, he thinks that these little button-holes are an important factor in the causation of hemorrhoids. We believe this to be in a measure true, but there are other factors that play a much more important part; because of gravitation, and the fact that the rectal veins have no valves, the erect posture assumed by man has a great deal to do in the production of enlarged veins. Again the fæces, by the time they reach the rectum, are solid, and frequently cause venous obstruction. Certain obstructive diseases of the heart and liver, a retroverted uterus, stricture of the rectum or urethra, chronic diarrhœa, overpurgation, stone in the bladder, or anything that presses upon the veins, are causes; frequent and prolonged straining will, sooner or later, produce hemorrhoids. Many cases can be traced directly to irregularities in living. In fact, anything that forces an abnormal amount of blood into the rectum, or interferes with its return therefrom, may be regarded as a cause.

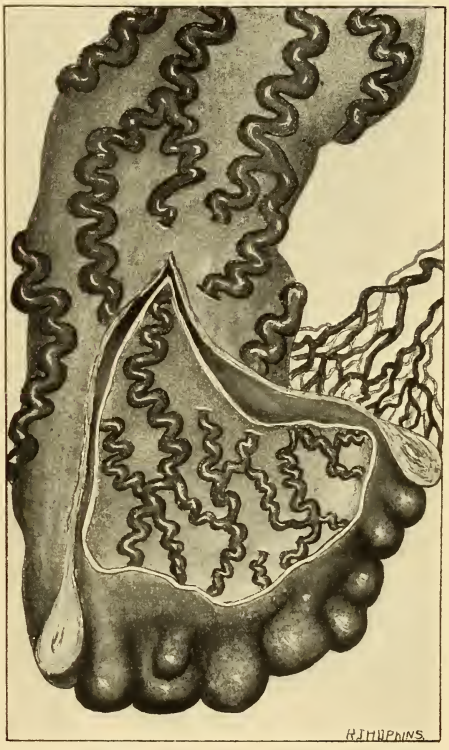

Fig. 351.—"The larger rectal veins pass through the rectal walls by means of little slits."—Gant.

External Hemorrhoids.—There are two kinds of external piles; when composed of hypertrophied folds of skin, they are called *cutaneous*, when filled with a firm dark clot, *thrombotic*. The former are usually chronic and are the colour of the skin, the latter come on suddenly, have a bluish tint, and look like a bullet beneath the skin.

Symptoms.—Under favourable circumstances they produce a sensation of fulness about the anus. When inflamed, a smarting is felt, and when relief is not to be had, the sphincter becomes irritable and the suffering is materially increased by its frequent contraction.

Treatment.—In so far as the palliative treatment is concerned, both varieties of external piles should be treated alike. The diet should be restricted to fluids and semisolids, and if this does not suffice, a laxative should be given. For this Gant prefers Carabaña water, 2 ounces in a tumbler of warm water before breakfast. The inflammation should be reduced by constant application of hot poultices, cold applications, or lotions composed of lead, zinc, alum, opium, krameria, or other astringent remedies. When the suffering is sufficient to keep the patient awake, relief may be had by an injection of one fourth of a grain of morphine sulphate. To allay pain and soothe the sphincter muscle, the following ointment, which the patient may use freely both inside and outside the anus, may be given:

℞ Morphinæ sulphatis..... grana vj to viij;
Calomel ..... grana xij;
Vaseline ..... ʒj.
Sig. Use freely.

An ointment composed of opium and belladonna is a good combination and will diminish pain.

Surgical Treatment.—When the physician has the election of the method of treatment in a given case, he should not waste time with palliative measures, but should relieve the patient quickly and permanently by operation, in one of two ways. The *cutaneous* pile should be cut off with the scissors and the edges of the wound brought together with catgut or allowed to granulate. The *thrombotic* variety should be laid open with a bistoury, the clot turned out, the rent in the vessel cauterized, and the cavity packed with gauze, which prevents hemorrhage and allows the blood to escape in case bleeding occurs. A *combination* pile should be treated as the internal variety, except that the incision should be extended to include some of the adjoining skin.

Internal Hemorrhoids.—There are two varieties of internal hemorrhoids: *capillary* and *venous*. The former are supplied principally by the superficial vessels of the mucous membrane, and the latter by the veins of the mucous and submucous tissues. Capillary piles are broad flat tumours that bleed readily and look very much like strawberries. Venous piles are of frequent occurrence and are composed of dilated veins. They may be small, may remain within the bowel and bleed freely, or they may be large and protruding, and may bleed occasionally (Fig. 352).

The *symptoms* of hemorrhoids vary according to the duration, kind, and violence of the attack. The following are some of the more common symptoms subject to the above conditions: (1) Protrusion all or a part of the time. (2) Bleeding varying from a few drops to a profuse hemorrhage. (3) A sensation in the rectum as if there was something in the bowel that ought to come away. (4) Pain, intermittent and slight, or excruciating and constant, according to the amount of inflammation, ulceration and strangulation. (5) Spasmodic contrac-

tion of the anal sphincters. (6) Extreme nervousness and loss of flesh. (7) When piles are ulcerated, there is more or less pruritus caused by the discharge. (8) When strangulation continues for several days, it causes constipation and a slight rise of the temperature.

Treatment: Palliative.—Correct errors in diet, keep the fæces soft, and return all protruding tumours when seen before strangulation has begun, for once they are caught outside the anus no attempt at reduction should be made, because the irritable sphincter would immediately throw them out again. The remedies suggested in the treatment of external hemorrhoids for the relief of pain and inflammation can be successfully employed in the treatment of internal hemorrhoids. When there is bleeding, it becomes necessary to inject astringent solutions into the rectum and, by means of a speculum, to apply styptics directly to the ulcers. This procedure will require several days, and the patient will suffer considerable pain before piles that are strangulated can be relieved, and patients should be made to understand this from the start.

Fig. 352.—"They may be large and protruding, and may bleed occasionally."—Gant (page 850).

Surgical.—Many authorities discountenance operation on piles that are strangulated, ulcerated, or inflamed, until after the reduction of the tumours and inflammation and the healing of the ulceration. Gant advises an operation irrespective of their condition, so soon as the patient's consent can be obtained, for the reason that she will be about after a radical operation in a shorter time than it takes to reduce the inflammation. Many operations have been devised for the cure of hemorrhoids, but the *injection*, *Whitehead's*, the *ligature*, and the *clamp-and-cautery* methods, are the only procedures worthy of special consideration.

Injection.—This method was the rage ten years ago; to-day, it is resorted to only in carefully selected cases. Any one who is foolish enough to attempt to cure all piles, irrespective of location or condition, by injecting them, will be sadly disappointed. He will not only fail to cure his patients, but will cause them much unnecessary

suffering and a greater loss of time than if they had had the clamp-and-cautery or ligature operation performed. This method of treating piles appeals to the patients because they do not have to take an anæsthetic, submit to the knife, and suffer pain, and they are not prevented from following their occupations. This is true in successful cases; but in others, their suffering is excruciating, because of sloughing, ulceration, abscess, or fistula, and they fail to be cured after all they have gone through. If only small pendulous piles, situated well above the grasp of the external sphincter, are injected, the results will be gratifying. Many solutions have been brought forward, but only those containing carbolic acid deserve commendation. This drug has been used successfully in combination with distilled water, glycerine, and olive oil, varying in strength from 4 to 75 per cent. Yount prefers the weaker, and Agnew the stronger, solution. Gant uses the following mixture:

℞ Carbolic acid..... ʒj;
Glycerine, }
Distilled water, } .....āā ʒj.

M. Sig. Inject from 5 to 10 drops in small, and from 10 to 15 in large piles, and see that they are pushed out of reach of the sphincter.

Whitehead's Operation.—This operation consists in detaching the mucous membrane from the skin and dissecting it from the submucosa until the upper part of the pile-bearing area is reached; it is then amputated and the distal end brought down and sutured to the skin with silk sutures, which are allowed to cut their way out. Whitehead says that it is the most natural method, requires few instruments and little dexterity, and that there is less pain, and danger of secondary hemorrhage from it than after either the ligature or the clamp-and-cautery operations. The operation is radical, but Gant's experience bears him out in saying that it is difficult and bloody, and requires more instruments, a longer time to perform, and causes more pain owing to tension, than either the clamp-and-cautery or the ligature. Because of tension and the danger of infection, nonunion is common. As a result, the portion of the bowel between the anus and the retracted gut is uncovered by mucous membrane, leaving a broad circular ulcerated band that eventually terminates in stricture, incontinence, and pruritus. There is also an absence of the normal secretions to lubricate the fæces, and a loss of sensibility to warn the patient of an approaching stool. When primary union is obtained, these patients are up and about in two weeks.

Ligature.—Only a few years ago nearly all the prominent surgeons of this country were doing the ligature operation. To-day, the clamp-and-cautery ranks equally with it in popularity, and in a few years more it will probably be the operation of election for the radical cure of piles. Hippocrates and Celsus used the ligature by simply placing

it around the pile and allowing it to slough off. Modern surgeons first make an incision at the mucocutaneous border before applying the ligature, in order that the nerves may not be included, and severe afterpain may be thus avoided. The final result of either operation is equally good, for both effect a radical cure in a much shorter time, and with fewer complications and less inconvenience than any other operation. B. M. Ricketts uses the ligature submucously, beginning at the muco-cutaneous margin (Fig. 353). The ligature may encircle in its sweep the bases of several tumours. Then, being brought out at the point of original insertion, it is tied, causing subsequent atrophy and disappearance of the hemorrhoids (Fig. 354).

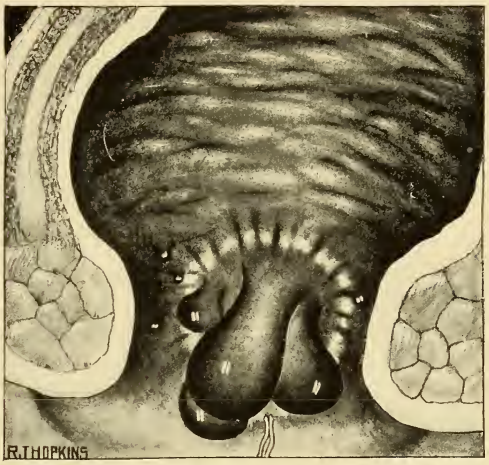

Fig. 353.—"B. M. Ricketts uses the ligature submucously, beginning at the muco-cutaneous margin." —Gant.

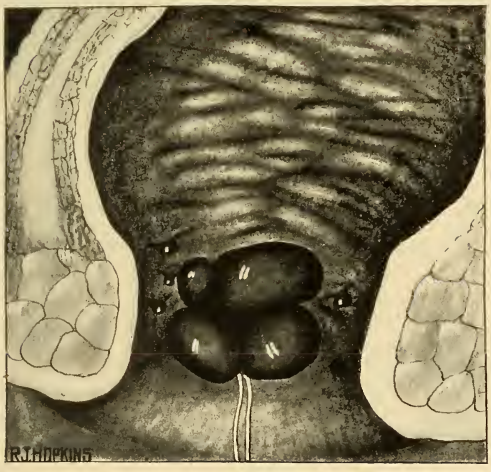

Fig. 354.—"Being brought out at the point of original insertion, it is tied."—Gant.

Clamp-and-Cautery.—This operation, as compared with the ligature, is comparatively new, yet it has been given sufficient trial by the profession to gain for itself an enviable reputation. Gant prefers this to the ligature operation because after it there is less pain, spasm of the sphincter, and bladder disturbance, and patients are able to resume their occupations more quickly. Hemorrhoids can be removed just as quickly with the clamp-and-cautery as with the ligature, and there is just as much danger of secondary hemorrhage occurring after one as the other (Fig. 355). Before he devised his own clamp (Fig. 356) Gant had a serious hemorrhage after this operation, due to an imperfect instrument allowing

a part of the stump to slip through the clamp after the tumour had been cut away, and before there was an opportunity to cauterize it. He has also had the same accident because of a ligature slipping during a violent attack of coughing. Bleeding does not occur when

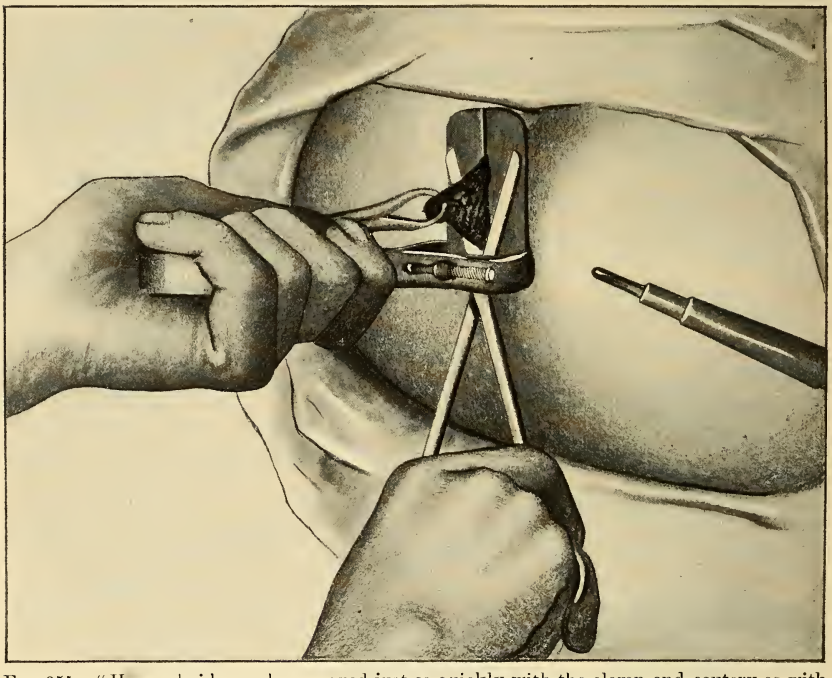

Fig. 355.—"Hemorrhoids can be removed just as quickly with the clamp-and-cautery as with the ligature."—Gant (page 853).

cauterization is properly done; the tissues should be thoroughly *burned* with the cautery at a red heat, and the clamp loosened and readjusted if there is any bleeding. Gant has been doing this operation constantly for the past ten years and has not had a fatal hemorrhage or a stricture or other accident following it. Mathews says: "I use this plan (clamp-and-cautery) in selected cases, viz., where there is a large amount of skin around the anus, which is embraced in, or goes to make up, a part of the internal hemorrhoid. If this amount of skin is cut off, excessive bleeding may occur. If an incision is made around it and it is ligated, we are chary about cutting too close to the ligature, and therefore we have much skin left and many ligatures." Gant's

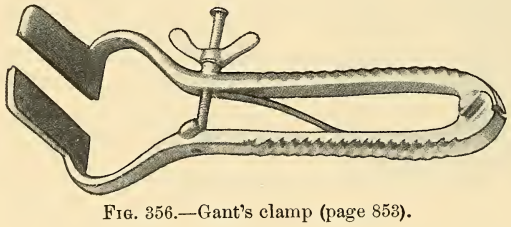

Fig. 356.—Gant's clamp (page 853).

experience has been the opposite of this; he has found that the bleeding following the removal of piles covered by skin is of no importance, and is easily arrested by a gauze compress. It is not surprising that patients thus operated on suffer great pain, for excruciating pain follows the cauterization of the skin in any part of the body, and Gant never removes a skin pile by the clamp-and-cautery for this reason; he does operate on all internal hemorrhoids in this way, because there is so little post-operative pain when the cauterization is confined to mucous and submucous tissues. Allingham says: "My most careful researches have led me to a conclusion that it (clamp-and-cautery) is quite six times as fatal as the ligature, properly and dexterously applied." He does not, however, point out what causes these fatalities, nor does he give statistics to substantiate his statement. Gant has never known of a person dying from this operation, nor has he seen such a case recorded in medical journals. No doubt there are cases of death from this cause on record, but the same can be said of the ligature operation.

CHAPTER LIII

PELVIC DISEASES AND NERVOUS AFFECTIONS

Coincidence of pelvic and nervous diseases—Neurasthenia: Symptoms, conclusions—Hysteria: Symptoms, pathology, conclusions—Operations for the neuroses—Nervous symptoms of pelvic disorders.

Coincidence of Pelvic and Nervous Diseases.—It has been thought wise that some one should present briefly in this treatise, from the standpoint of the neurologist, the essential facts in regard to the nervous affections to which women are especially liable. As is well known, pelvic and nervous diseases frequently exist concurrently in the same patient. This fact alone makes a consideration of the nervous features of special importance. Besides, the advance made in the study of functional nervous diseases has been equally great with that made in gynecology. Views, new and comprehensive, now throw light upon fields where formerly there was only darkness and confusion.

Neurasthenia is one of the two great neuroses to which women are especially liable, the other being hysteria. Too often the physician turns aside from the subject of neurasthenia as uninteresting, as being a term applied to a condition rather than a disease, and as presenting symptoms that are vague and ill defined, from a study of which nothing definite can be gained. In reality, neurasthenia is an exceedingly interesting affection; one which, far from displaying a vague and ill-defined symptomatology, presents a symptom group as fixed and as definite as that of any disease with which we are acquainted. It is true that, now and then, the symptoms differ widely in detail, but they always present the same essential features. They are always expressive of fatigue, and Dercum has, therefore, proposed for neurasthenia the far more expressive name of the *fatigue neurosis*. The stamp of fatigue is ineffaceably fixed upon every case. Every symptom is expressive of weakness, of irritability, and of ready exhaustion. A brief glance at the clinical picture will bear this statement out.

The *symptoms of neurasthenia* resolve themselves into sensory, motor, general somatic, and psychic disturbances. Most of them are the direct result of chronic overfatigue; a smaller number are an indirect result, and these serve, at times, to complicate the picture. Dercum has separated the symptoms into two great groups: first, the primary or essential symptoms of neurasthenia; and, secondly, the secondary or adventitious symptoms.

Beginning with the *sensory symptoms* we have, first, a general sense of fatigue or tiredness. This may be diffused throughout the entire body, but is generally accentuated in special regions, e. g., the head, the back, or the limbs. It is characteristic of this sense of fatigue that, in the simple and typical cases, it is brought on if absent, or made worse if present, by effort. It is expressive of diminished power for the sustained expenditure of energy, and it is to be looked upon as one of the primary symptoms of neurasthenia. The sensation that characterizes it is one of generalized distress or discomfort diffused throughout the entire body, and is not referred to any particular region. In this respect, it closely resembles the sensation of fatigue that follows prolonged exertion in perfectly healthy persons. However, if the conditions causing this general sense of tiredness persist, the sensation ceases to be merely one of fatigue and becomes one of pain. In other words, when fatigue sensations become exaggerated, they become painful, and they are then described by the patient as *aches* of various kinds and are referred to special regions. Very commonly, for instance, the patient complains of headache. When present in a mild degree, this headache is diffused, and is described as a dull feeling or a dull aching, and is then relieved by the mere cessation of work, that is, by rest. When it is more pronounced, it becomes accentuated in certain regions. Thus, it is referred especially to the occiput and the upper portion of the neck, and is often associated with sensations of drawing and tension. At other times, though less frequently, it is referred to the brow or to the vertex. Often other sensations are present, such as pressure, constriction, giddiness or ringing in the ears. These sensations are not themselves the direct outcome of fatigue, but belong to the group of the secondary or adventitious symptoms, mentioned above. They may or may not be present.

Next in frequency to headache, patients complain of backache. This, at first, may consist of a simple feeling of fatigue referred to the lumbar region, which is relieved by lying down, but which, later, may become so exaggerated as to make backache the most prominent feature of the case. This backache is, as a rule, widely diffused over the lumbar region; it sometimes extends over the sacrum and gluteal regions, and at other times, and more frequently, upward over the dorsal region, especially between the shoulder blades. Often, cutaneous hyperæsthesia makes its appearance, so that the back, especially over the vertebræ, becomes sensitive to pressure. Frequently, this painful hyperæsthesia is present in spots that can be covered by the tip of the finger. It is found especially over the seventh cervical spine, over the upper thoracic spine, sometimes over the lumbar spine and sacrum, and very frequently indeed over the coccyx. Without going into details, it may be said that these symptoms, which were formerly and incorrectly grouped under the head of spinal irritation, clearly belong to the secondary, or adventitious, symptoms of neurasthenia. Not infrequently, an especially painful spot is found slightly below and within

the left shoulder blade. Less frequently, a painful area is found in a similar situation below the right shoulder blade.

Fatigue aches may also be referred to the limbs, namely, to the arms and shoulders, the hips, the thighs, or the legs. They consist, as a rule, of a dull aching, which is diffused through the tissues, generally diminished or relieved by rest and made worse by exertion. Limb ache is not infrequently associated with the special occupation of the patient. Thus Dercum has observed arm ache in a neurasthenic pocket-book-maker, leg ache in neurasthenic letter carriers and collectors, and not infrequently, as a matter of course, in neurasthenic saleswomen.

When we turn our attention to the *phenomena presented by the special senses*, we find that the symptoms are also expressive of chronic fatigue; but without stopping to analyze them here, as this would be too great a departure from the legitimate object of this chapter, it may be merely stated that the symptoms are those of ready exhaustion. As regards the eye, they are referable to fatigue of the accommodative apparatus, of the retina, or, it may be, of the cerebral centres. One of the common statements which we hear from neurasthenics is that they can not read for more than a few minutes at a time, that the letters become blurred, and that the effort gives rise to pain, generally headache or other cephalic distress, such as vertigo. Similar truths obtain with regard to the other special senses.

When we turn to the *motor symptoms* of neurasthenia, we find that these, also, are expressive of fatigue. They consist more especially of muscular weakness, which develops rapidly under exertion, of tremor, and of various modifications of the tendon reactions. The object of this chapter forbids their discussion in detail, as well as a consideration of the visceral and general somatic disturbances. These have been fully considered elsewhere. Suffice it to say, that the disturbances of circulation, of digestion, of secretion, and of the sexual functions are, all of them, manifestations of chronic fatigue. For instance, the primary symptom referable to the digestive tract is that of digestion delayed and enfeebled, an atonic indigestion, both gastric and intestinal. The disturbances of circulation are manifested by feebleness of the pulse, coldness of the extremities, disturbances in the rhythm of the heart's action, and even by heart murmurs. The disturbances of secretion are evidenced by change in the character and quantity of the perspiration, of the urine, and of the saliva; these again are also purely and solely related to fatigue. When we turn our attention to the psychic disturbances, we find that they, too, are expressive of fatigue. A marked and characteristic symptom, namely, the diminution of the capacity for sustained intellectual effort, is invariably present. As the patient is incapable of long-continued physical labour, so is she incapable of long-continued mental labour. The attempt to perform mental labour, sooner or later brings on symptoms of exhaustion, and if the task is persisted in, marked fatigue sensations make their appear-

ance, especially headache. Associated with the impairment of the power of sustained effort, there is a lack of power of concentrating the attention, and this the patient frequently mistakes for loss of memory. In addition to these symptoms, there is a lack of spontaneity of thought and a diminution in the strength of the will, a condition of general indecision and of mental and emotional irritability. Frequently, fear also is present, and may assume a general or a special form; in the latter case, it gives rise to the various specialized fears, such as claustrophobia, agoraphobia, etc.

If we pause to analyze the primary symptoms of neurasthenia, we find that they are always expressive of chronic fatigue, but there is present, as the essential condition, not only a marked and persistent diminution of nervous energy, but also an *increased reaction, mental and physical, to external impressions.* In other words, to nervous weakness there is of necessity joined nervous irritability. Diminished resistance to fatigue implies diminished resistance to impressions from without; weakness and irritability are thus necessarily associated. This is seen, for instance, in the motor symptoms, where muscular weakness is associated with increased reflex excitability, and in the sensory symptoms, where, to the fatigue sensations, there are sooner or later added the symptoms of local hyperæsthesia; this is the explanation of the hyperæsthesia so often found over the spinous processes, over the coccyx, and over various other areas. Another illustration of the same general truth is found in the fatigue of the eye; here, the patient is not only unable to use the eyes persistently, but there is also present, sooner or later, painful hyperæsthesia, i. e., an irritability of the eye to light, so that neurasthenics often begin to wear smoked glasses of their own accord. It is this increased reaction to impressions from without that is of striking importance, as we shall presently see, when we deal with organic affections occurring in neurasthenic subjects.

Briefly restating the facts, we find that the two cardinal conditions of the fatigue neurosis, neurasthenia, are (1) persistent nervous weakness, and (2) increased nervous irritability, that is, increased reaction of the organism to impressions from without. When we apply this interpretation of neurasthenia to the study of the diseases of the various special organs, we find at once that a ready explanation is presented for many of the strange facts we meet with. How remarkable it is that an eye defect often remains undiscovered for years; but a man who has become neurasthenic now finds that exertion of the eyes brings on headache, or makes headache worse, if present, because his resistance to fatigue has been diminished; in other words, an exertion so slight as to be utterly inadequate to evoke any symptoms whatever in a healthy man, may in a neurasthenic rapidly bring on a fatigue headache, now termed an eye headache. In the same way, a local defect or disease in other portions of the body may remain undiscovered so long as the general health remains good, and may only make itself felt when neurasthenia becomes established—i. e., when the nervous system pre-

sents the phenomenon of increased or abnormal reaction to local impressions. This fact has especial application to gynecology. It is well known that a woman with a laceration of the cervix or perineum, a displacement, or possibly a prolapsus, of the ovary, may make no complaint so long as her general health remains good; not infrequently, she fails to seek medical advice for the pelvic condition until neurasthenia has become established.

The foregoing considerations of neurasthenia warrant the following almost self-evident *conclusions*:

First, that neurasthenia may exist independently of any local disease, pelvic or otherwise.

Secondly, that neurasthenia and pelvic disease may exist independently in the same individual.

Thirdly, that when pelvic disease is present with neurasthenia, the pelvic symptoms may be more readily recognised by the patient and therefore become more prominent, because in neurasthenia the reaction of the nervous system to abnormal or pathologic impressions is greatly increased. Without pausing to apply these conclusions to the question of surgical intervention let us turn our attention to hysteria.

Hysteria, as has already been stated, is one of the two leading neuroses occurring in women. Dercum knows of no affection concerning which there is still so great a lack of knowledge in this country and in England, notwithstanding the fact that the French, and later the Germans, have unmistakably defined and described the symptomatology of this disease. We frequently hear it stated, and almost as frequently see it printed, that hysteria is a disease without a syndrome; that it is a disease which presents an " infinitude of shifting polymorphic nervous disturbances." This last phrase is borrowed from a textbook on the practice of medicine, published in this country no earlier than 1897; and nothing could be more untrue. In reality, hysteria presents a syndrome that is as fixed and as definite as that of any other disease with which we are acquainted.

The symptoms of hysteria, particularly its cardinal symptom, like those of neurasthenia, are always present and always characteristic; while it is equally true that other symptoms, secondary in importance, are from time to time added, though the number of the secondary symptoms is far less than those met with in neurasthenia. Dercum terms hysteria a *psychoneurosis* because the physical symptoms present in it are dominated by mental phenomena, themselves the result of a genuine and profound affection of the cerebral centres. Prominent, for instance, are emotional disturbances and modifications of the will, but to these are added physical signs so striking that they can never be misunderstood. The symptoms of hysteria, like those of neurasthenia, consist of sensory, motor, general somatic and psychic phenomena. Let us begin with the sensory symptoms. In neurasthenia, the sensory symptoms consist for the most part of fatigue sensations combined with symptoms of sensory irritability. In hysteria, on the other hand, fatigue sensations are

absent, but instead there may be present true anæsthesia, complete or partial; in other words, we are at once impressed with the fact of *true sensory loss,* which never occurs in neurasthenia. Further, this sensory loss or anæsthesia is so characteristic as to enable us frequently to make a diagnosis of hysteria from it alone. Allusion need only be made to the symptom of hemianæsthesia, in which anæsthesia is confined to one half of the trunk and head, and to the limbs of one side. Strange to say, this sensory loss involves most frequently the left side. Again, the loss of sensation may be less widely distributed, in which case it is frequently characterized by peculiarities of location; for instance, it may be confined to a segment of a limb, that is, it may extend from the elbow to the wrist, or from the knee to the ankle, and is then termed segmental anæsthesia; again, it may cover the fingers, hand, wrist, and the arm up to a certain level, like a glove, and is then spoken of as glovelike anæsthesia; or it may cover the foot, ankle, and the leg up to a certain level, and then is spoken of as stockinglike anæsthesia. At other times, it assumes curious geometrical or irregular shapes. A fact which strikes the observer at once is the absence of correspondence between the various areas of anæsthesia and any nerve supply or any sensory representation in the spinal cord. This fact naturally refers us, while seeking for the seat of the disturbance, to the cerebrum. As regards hysterical hemianæsthesia, this cerebral involvement is further rendered probable by what we know of the pathology of organic hemianæsthesia, and it becomes still more probable when we reflect that the facts at our disposal lead us to infer that the representation of the limbs in the cortex is by segments. To sum up, therefore; in hysteria it is the distribution of the sensory loss which is characteristic, and which at once stamps it as hysterical. An important fact, however, should in this connection be borne in mind, and that is that the sensory losses in hysteria are most frequently far from being complete. Indeed, the most frequent condition that we find is that of *diminution of response* to tactile, to painful, and to thermal impressions, there being present under these conditions merely a general lessening of sensation, a hypo-æsthesia, or hypæsthesia—as it is termed technically. Partial sensory losses, therefore, having the peculiar distribution that has been stated, are as unmistakable in their significance as total sensory losses, which are less frequently met with.

Far more important, however, than anæsthesia or hypæsthesia, is the *hyperæsthesia* which is found in hysteria. This, also, may have a most varied distribution, but as a matter of clinical fact it seeks by preference certain localities. Thus, most frequently, there are found areas of hyperæsthesia under the breasts, so-called "*inframammary tenderness,*" and areas of hyperæsthesia above the groins, grossly misnamed "*ovarian tenderness.*" These areas of hyperæsthesia are sometimes found on both sides of the body; more frequently, however, they are limited to one side of the body, and, curiously enough, like hemianæsthesia, they are found most frequently upon the left side. Areas

of hyperæsthesia are also frequently found upon the scalp, and here the patch is often so small that it can be covered with a finger-tip.

Not infrequently, these areas of hyperæsthesia become areas of excessive pain, hyperalgesia. The areas are not only tender, but they become painful—not only painful to touch, but spontaneously painful. A familiar instance is found in the hyperæsthetic area upon the scalp, which, when spontaneously painful, gives rise to severe headache, that form of headache known as *clavus hystericus*. What is true of the hyperæsthetic area of the scalp, is also true of the hyperæsthetic area below the breast; sometimes it centres in the nipple and then gives rise to mastodynia.

That both clavus and mastodynia are affections attended with much suffering, no one will deny. When the area of hyperæsthesia in the inguinal region becomes painful, the suffering may be equally great. Owing to the anatomical relation which the inguinal region bears to the ovary, inguinal pain has been greatly misunderstood. As already stated, it has been misnamed ovarian tenderness, and has been directly attributed to the ovary; and yet there can be no doubt with regard to the nature of this pain, for we must remember that it is quite frequently found in men, as well as in women in whom the ovaries have been removed—removed sometimes in a vain attempt to relieve this pain. The pain is not ovarian; it should never have been called ovarian. Inguinal tenderness, groin pain, or, as Dercum prefers, *inguinodynia*, are terms much simpler and in strict accordance with facts. The pain is, as a rule, confined to a limited area, and is found most frequently upon the left side; and it is very often associated with a similar, though somewhat larger, area of tenderness beneath, or over, the left mammary gland, and, it need hardly be added, with other definite, well-marked hysterical stigmata. As a rule, it is revealed, by careful examination, to be superficial and not deep. It is situated in the skin and the tissues of the abdominal wall, and not within the pelvis. Dercum has frequently demonstrated this to be a fact by means of the following procedure:

The painful area having been carefully localized on the abdominal surface, the tip of the forefinger of the right hand is allowed to rest lightly upon it; the left forefinger is then introduced into the vagina and directed upward and to the right, until its tip is immediately beneath the tip of the forefinger of the right hand which is upon the abdominal wall. Just as soon as pressure is made between the two fingers, the patient flinches; while the patient does not flinch when pressure is made in other directions or when other portions of the abdominal wall are included. By this means Dercum has succeeded not infrequently in isolating and demonstrating beyond a doubt the site, and therefore the character, of this pain. In some cases, just as in spinal tenderness, the pain radiates and becomes somewhat diffused; but it always radiates from a superficial centre in the abdominal wall; and just as there are cases of spinal tenderness in which the tenderness

is at one time superficial, and at another deep, so there are cases of inguinal tenderness in which the tenderness seems at times to be deep-seated; but even here, by the procedure just described, the maximum point of pain can always be isolated and shown to exist in the abdominal tissues. This hysterical inguinal pain has frequently forcibly suggested to Dercum the clavus hystericus—the boring penetrating pain that hysterical patients feel in limited areas about the head; and, indeed, not infrequently this inguinal pain is just as severe, but it is no more intrapelvic in its origin than is the clavus of the head.

It is not necessary to speak of the contracture of the visual fields in hysteria, nor of the reversal of the colour fields, as they do not in this chapter directly concern us. They must, however, be borne in mind as affording valuable corroborative evidence of the existence of hysteria. The motor symptoms of hysteria are less frequently met with than the sensory disturbances which we have just considered. The motor symptoms consist, in brief, of paralysis, contracture, tremor and inco-ordination. The presence of motor symptoms generally causes the case to be referred to the neurologist in the beginning, rather than to the gynecologist, and they, therefore, will not be considered in this connection. Similarly, with the visceral symptoms, which consist of disturbances of digestion, of the circulation, of the heart, of respiration, of fever, of cough, of loss of voice, of yawning, of phantom tumours, etc. They also are less likely to come before gynecologists for interpretation, and, moreover, are so characteristic as to stamp the case at once as hysterical.

The *psychic symptoms* of hysteria, however, are important for the gynecologist. There is always some abnormity of the mental faculties in hysteria, more particularly a hyperæsthesia and irritability of the affectional or emotional faculties. The patient is, as a rule, exceedingly impressionable, and reacts inordinately to impressions involving these faculties. She is abnormally sensitive to suggestions, especially with regard to her physical condition, and willingly accepts explanations attributing her symptoms to local disease. Not infrequently, hysterical symptoms are brought to the surface, or, if present, are made prominent, by the ill-considered statements or injudicious interest manifested by the patient's friends. It can be readily seen how doubly injurious under such circumstances incautious statements by a physician, or a pelvic examination, even when the latter yields a negative result, may be. One can hardly judge of the enormous mental impression a first examination must make upon a young girl, especially if that girl is already hysterical, already neuropathic by heredity and predisposition. Not only is the great evil of the moral shock to be taken into account, but also the fact that there is lodged in the patient's mind a more or less vague but fixed belief that she has some mysterious local disease to which she only too willingly agrees to attribute her nervous manifestations. In consequence, she sooner or later insists upon a repetition of the examination or a continuance of the local treatment once

begun, and the morbid idea thus implanted may become hopelessly rooted, never, perhaps, to be displaced. The enormous rôle which the mental condition in hysteria plays, must constantly be borne in mind. Hysteria appears to be a functional disturbance of the entire nervous system, but with a special involvement of the cerebral cortex.

The *conclusions* that the above considerations justify, are the following:

First, that hysteria may exist independently of any local disease, pelvic or otherwise.

Secondly, that there is no essential relation between pelvic disease and hysteria, even when the two affections coexist in the same case.

Thirdly, that while in hysteria there is an increased reaction to external impressions, this reaction is purely psychic. The patient is exceedingly impressionable, and reacts inordinately to impressions involving the affectional or emotional faculties. This reaction to external impressions differs altogether from that seen in neurasthenia, for, in the latter, the reaction involves the nervous system as a whole. In hysteria, the patient readily accepts the suggestion—often a spontaneous self-suggestion—of pelvic disease, especially as groin pain is so common a symptom of hysteria.

Fourthly, that the pain areas of hysteria bear no relation to disease of the deeper structures.

Operations for the Neuroses.—Evidently the surgeon can not hope by operation to remove the symptoms characteristic of the neuroses, but only those symptoms properly belonging to the pelvic disease itself; and his operation should never be undertaken for any other purpose. To state the truth in other words, the surgeon should operate for the pelvic condition itself. For instance, if he operates on a tear of the perineum, he should do so because the tear has resulted in mechanical difficulties—because it has given rise to a displacement of the uterus or perhaps to a rectocele, not because the tear occurs in a neurasthenic or hysterical woman. If he removes an ovary, it should be because the ovary is unmistakably diseased. If he removes an appendix, he should do so because the characteristic symptoms of appendicitis are present, and not because the patient suffers from neurasthenia or hysteria. If he sews fast a movable kidney, it should be because the mobility of the organ is such as to threaten mechanical obstruction of the ureter with its consequent hydrops of the kidney, or because the patient suffers from irregularly recurring attacks of gastro-intestinal cramp directly dependent upon the abnormal mobility of the organ, and not because she is neurasthenic or hysterical. Operations should be performed, not for the relief of an incidental nervous symptom, but because of the local condition itself; just as we set a broken leg in an insane man, not because he is insane, but because the leg is broken.

The surgeon should approach cases of neurasthenia and cases of hysteria somewhat differently. Contrary to what might, perhaps, be

inferred, Dercum believes that, in neurasthenia, operations for the cure of actual pelvic lesions are indicated, and should, other things being equal, be performed. We remember that in neurasthenia there is added to nervous weakness, nervous irritability; that there is an increased reaction to local disease, and it is just as clearly indicated to correct local pelvic disease in neurasthenic patients as it is to give such patients glasses to relieve their ocular symptoms. It is important, however, in considering operations upon neurasthenics, to bear in mind that these patients are excessively sensitive to nervous shock. All gynecologists are familiar with the persistent nervous symptoms—the persistent surgical neurasthenia—that ensues in some patients after pelvic operations. If such operations are undertaken upon persons already neurasthenic, great harm may be done. Therefore, if, in a case requiring pelvic operation, neurasthenia is present in any degree (provided, of course, that the operation is not urgently indicated for surgical reasons), Dercum believes that the patient does better if the operation is preceded by a period of rest. If the patient, instead of being neurasthenic, is hysterical, a period of preliminary rest is even more strongly indicated. This he believes to be specially true when the hysteria is very profound. In the latter case, operation should be deferred, unless, of course, the surgical indications are urgent.

Nervous Symptoms of Pelvic Disorders.—A view is entertained by many physicians that certain nervous disorders are the direct result of pelvic lesions. Unfortunately, the increase of our knowledge regarding functional nervous diseases does not bear out these assertions. The nervous symptoms caused by pelvic disease are, as a matter of fact, exceedingly limited. It is true that there is present pelvic pain, pain referred to the back and to the hips and thighs, together with more or less marked indications of general ill-health, but certainly these symptoms can not be dignified by the term of a nervous disorder. They are a part of the pelvic disease itself, and are directly symptomatic of it. They do not constitute neurasthenia or hysteria.

Many years ago a doctrine, known as the doctrine of reflex nervous disorders, had an exceedingly strong hold upon the profession. An increasing knowledge of the various functional nervous diseases has demonstrated this doctrine to be utterly fallacious. Long since, the practice of circumcision for epilepsy has been abandoned, as has also the removal of ovaries for the cure of the same disease and of hysterical convulsions. Both procedures had equally little foundation and both were equally unscientific and barbarous.

The reader can readily understand why it is unnecessary to discuss the relation between the pelvic disease and epilepsy, chorea, and other nervous diseases. The truth can all be summed up in a word, there is *no relation*. The same truth obtains with regard to the insanities. For instance, the various abnormities of menstruation that are observed in the course of an insanity, are the indirect sequelæ of the general ill-health from which the patient suffers, and not due to any apocryphal

relation between the condition of the pelvic organs and the insanity. Insanity, like epilepsy, depends upon morbid changes within the nervous system itself; these changes in turn being dependent, in all probability, upon profound, and as yet undetermined, changes in the general nutrition of the organism. The statement is sometimes made that insane patients who have been subjected to operation sometimes get well, but we should remember that a lucid interval or even an apparent cure sometimes follows a mere physical shock, such as a fall or other trauma. Indeed, a recovery is not an infrequent result of some intercurrent infectious malady, such as erysipelas or typhoid fever.

A full and dispassionate consideration of the entire subject leaves to the surgeon no other option than to *operate for surgical indications only*; and, in certain cases, where the nervous disorder is grave, as in profound hysteria, profound neurasthenia, and in insanities attended with great exhaustion, operation should be undertaken only when the surgical indications are urgent. (See Indications for Oöphorectomy.)

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THE END

A TEXT-BOOK ON SURGERY:

GENERAL, OPERATIVE, AND MECHANICAL.

By JOHN A. WYETH, M. D.,
Professor of Surgery in the New York Polyclinic; Surgeon to Mount Sinai Hospital, etc.

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From Author's Preface.

The original edition of this work was published in 1886. It was revised and enlarged in a second edition in 1890. Within the period of seven years to this date (November, 1897) so many important advances have been made in surgical science and the operative technique that the author has found it necessary again to revise and practically rewrite this volume. To add all that was new and acceptable to that which experience had already demonstrated to be useful has of necessity increased the number of pages and size of the book. By careful elimination of matter which could with least disadvantage be left out, this volume, however, only exceeds the former by one hundred and twelve pages.

It has been the author's aim to retain those features of the original work which made it available to the busy practitioner for quick and ready reference, and to add to this edition some elementary pages which may commend it to teachers for their undergraduate pupils. With this end in view the matter has in great part been rearranged.

The introductory section is devoted to surgical pathology, subdivided into six chapters. These chapters treat of inflammation and the process of repair in the various tissues of the body, and the differences in repair in a tissue affected with simple or non-infective and infective (or suppurative) inflammation. Specific and non-specific urethritis, erysipelas, actinomycosis, glanders, tetanus, malignant œdema, hydrophobia, tuberculosis, syphilis, leprosy, diphtheria, and typhoid infection are also embraced in this portion of the work.

Chapters VII and VIII are devoted to surgical dressings, sterilization, asepsis and antisepsis, and anæsthesia.

In Chapters IX and X are given hæmorrhage, wounds, burns, skin grafting, frostbite, furuncle, carbuncle, ulcers, and gangrene. Bandaging is given in Chapter XI, and Chapter XII is devoted entirely to amputations.

Chapters XIII, XIV, and XV deal with the lymphatic vessels and glands, veins, arteries, aneurism, and ligation of the vessels.

In Chapters XVI and XVII are given the lesions of the bones and joints, and the various operative measures for their correction.

The chapters from XVIII to XXIX inclusive are devoted to regional surgery, and in that portion of this section in which the abdomen is considered many important changes have been made and much new matter added. Chapter XXX takes up deformities and their correction, while the final chapter (XXXI) is devoted to the subject of tumors.

D. APPLETON AND COMPANY, NEW YORK.

A TEXT-BOOK OF GENERAL SURGERY.

By DR. HERMANN TILLMANNS,
Professor in the University of Leipsic.

VOLUME I.

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